MECHANICAL HANDLING

INCORPORATING 'MATERIALS HANDLING'

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AUTOMATA AND MEN

THE idea of a robot, or artificial servant, capable of carrying out the more menial tasks of life, has been one of man's oldest dreams. Ever since Hero of Alexandria invented his series of automatá in the second century B.C. (or, as some would have it, the first century A.D.), there has been a succession of inventors and philosophers who have been credited with the manufacture of mechanical figures capable of performing certain specific duties. Sometimes, as in the case of Albertus Magnus and Regiomontanus, these achievements are surrounded in mystery or legend; but others, such as the automata of Jacques de Vaucanson (1709-1782), represent solid examples of the mechanic's art, and some of them can even be seen to-day if one knows where to find them.

Most of the authentic automata of the past were built purely for entertainment purposes. They played musical instruments, drew pictures and performed similar party tricks. But there have also been legends of others who performed such useful tasks as answering the door or lighting the fire. Nevertheless, it was not until Blaise Pascal developed his simple calculating machine in 1642 that the first successful mechanical simulation of man's mental, as distinct from physical, activities was achieved. Thus began the trend which culminated in the high-speed computers of the modern age.

Today, the elimination of human drudgery is already far advanced. Means are to hand for the mechanization of most of the heavy lifting, pulling and carrying jobs of industry and commerce. Even so, only a fraction of the potential benefits of these new methods are being utilized. Although the increasing mechanization of 'mental' activities holds promise for the most spectacular developments for the future, there is still considerable scope for the improvement of purely physical operations. A lot of unnecessary manual work is still being done in industry—work that could be accomplished more cheaply and efficiently by mechanized methods. People in industry should resolve, individually, to do all they can to hasten the day when, in Wiener's phrase, 'the human use of human beings' is universal.

SEVENTH MECHANICAL HANDLING EXHIBITION

(Organized by this journal)

Arrangements are now well in hand for the Seventh Mechanical Handling Exhibition, to be held at Earls Court, London, next year. Readers are asked to note that the Exhibition will be opened on Tuesday, May 3rd, and will remain open until Friday, May 13th, 1960.

Pour les lecteurs de l'étranger
Für unsere ausländischen Leser
Para los lectores de ultramar

SUMMARY OF CONTENTS

For readers overseas

SOMMAIRE EN FRANÇAIS

Utilité des électro-aimants de levage pour la construction des navires
Par un rédacteur du Journal page 126
Cet article décrit un nouveau type d'électro-aimant de levage léger, construit par assemblage et non pas coulé, que l'on emploie actuellement sur trois chantiers de constructions navales du Royaume-Uni. Etant donné que ces électro-aimants pèsent la moitié moins que ceux que l'on coule en fonderie, ils se sont avérés particulièrement avantageux lorsqu'on en utilise plusieurs ensemble sur une poutrelle d'écartement—par exemple pour manutentionner les grosses tôles d'acier—car, pour ce genre de travail, il y a bien moins de perte de capacité de la grue du fait du poids des électro-aimants, ce qui permet par conséquent de lever une charge utile proportionnellement plus forte.

Atelier de peinture mécanisé page 129
Ici, on décrit et illustre le matériel mécanisé installé pour peindre les automobiles dans une usine de montage sud-africaine.

Transporteurs et élévateurs volants
15éme Partie page 133
Par J. M. Beskine, B.Sc.(Eng).

Mécanisation des ports—Problèmes et avantages page 138
Où l'on souligne qu'il faut s'aviser de plus en plus de l'impérieuse nécessité de mécaniser la manutention des marchandises et frêts maritimes pour accélérer le retour des navires et attirer vers nos ports un plus gros commerce avant qu'il ne soit trop tard.

Manutention à l'usine de l'avenir
Par un rédacteur du Journal page 141
C'est le deuxième des deux articles passant en revue le matériel remarqué à la récente Exposition des calculateurs Electroniques à Londres.

Un nomogramme simplifie la spécification de largeur de courroies de transport page 145

Un Service pour les tracteurs
Par K. Mumby page 146
Compte rendu d'un enquête sur les facilités offertes aux utilisateurs de tracteurs à chenilles par l'organisation du service et pièces de rechange de la firme Leverton of Leeds, Ltd.

Chariots de manutention dans les ports de l'Afrique Orientale anglaise page 153
Bref compte rendu sur l'emploi des chariots élévateurs à fourche et à plate-forme dans les cinq ports de l'Afrique Orientale anglaise.

Le transport des matières premières par 'vacuumation', ou système pneumatique page 154
C'est la description illustrée d'un système de transport pneumatique pour la manutention du graphite. Cette installation a remplacé la manutention manuelle du graphite des dépôts de graphite en vrac jusqu'aux chaînes où s'effectue la production. On a ainsi réalisé un rendement de manutention plus élevé, tout en éliminant l'inconvénient de la poussière.

Manutention des colis page 156
Par J. W. Leech
C'est un tour d'horizon des nombreux types différents de convoyeurs actuellement disponibles pour la manutention des colis, caisses, cartons, bouteilles et autres articles similaires.

Nouveau service de frêt pour unités de chargement page 165
Compte rendu de l'ouverture d'un nouveau service de transport maritime entre Liverpool et Belfast. Les navires sont spécialement prévus pour le transport de containers uniformes en aluminium d'une capacité de 12 tonnes, spécialement destinés au transport des marchandises de porte à porte.

Un tracteur-pelle mécanique aux usages multiples page 167
Compte-rendu de la démonstration des performances impressionnantes du 'Matbro Mastiff', le tracteur-chargeur sur roues. Manoeuvrabilité exceptionnelle et rendement très supérieur dans la transmission de l'effort de traction sont les preuves manifestes d'un dessin technique inhérent très réussi.

Exposition de l'Electrotechnique page 171
Examen préalable d'une sélection du matériel qui sera présenté à l'Exposition de l'Electrotechnique, qui aura lieu à Earls Court, Londres, du 17 mars au 21 mars.

Nouvelles de personnalités page 174

Revue du matériel nouveau page 175

Notes et avis professionnels page 180

Publications reçues page 183

Sommaires et Références page 183
Les articles sur la manutention mécanique publiés dans les revues et journaux techniques et industriels dans le monde entier sont catalogues et abrégés sous cette rubrique.

Brevets récents page 185

INHALTSÜBERSICHT AUF DEUTSCH

Hubmagneten für den Schiffbau Seite 126
Von einem Mitarbeiter
In diesem Artikel wird ein neuer leichter Hubmagnet beschrieben. Es handelt sich hierbei um einen Magneten zusammengesetzter Bauart an Stelle der üblichen Gusskonstruktion, der sich zur Zeit in drei britischen Schiffswerften im Einsatz befindet. Da diese Magnete 50% leichter als Gussmagnete sind, erweisen sie sich dort als besonders vorteilhaft, wo mehrere zusammen an einem Spreizträger angewandt werden können, wie z.B. beim Verladen schwerer Stahlplatten, da hierbei viel weniger Krankapazität durch das Gewicht der Magnete in Anspruch genommen wird und somit eine entsprechend grössere Nutzlast gehoben werden kann.

Mechanisierte Lackierwerkstatt Seite 129
In diesem bebilderten Artikel wird eine Anlage für die maschinelle Spritzlackierung von Kraftwagen in einem südafrikanischen Montagewerk beschrieben.

Nichtortsfeste Förder und Hebegeräte
Teil 15 Seite 133
Von J. M. Beskine, B.Sc.(Eng.)

Hafenmechanisierung—Probleme und Vorteile Seite 138
Ein Aufforderung, der Notwendigkeit des mechanisierten Warenumschlags grössere Beachtung zu schenken, um die Schiffsliegezeiten zu verkürzen und unseren Häfen mehr Arbeit zu bringen bevor es zu spät ist.

Materialfluss in der Fabrik der Zukunft Seite 141
Von einem Mitarbeiter
Dies ist der zweite von zwei Artikeln über Anlagen und Ausrüstungen, die auf der kürzlich in London abgehaltenen Rechenmaschinenausstellung gezeigt wurden.

Nomogramm vereinfacht Spezifikation von Fördergurtbreiten Seite 145

Schlepper-Kundendienst Seite 146
Von K. Mumby
Bericht über die Leistungen, welche Besitzern von Kettenschleppern von der Kundendienst- und Ersatzteilabteilung der Fa. Leverton of Leeds, Ltd., geboten werden.

Hubkarren in den Häfen Britisch-Ostafrikas Seite 153
Ein Kurzbericht über den Einsatz von Gabelstaplern und Pritschenwagen in den 5 britisch-ostafrikanischen Häfen.

Rohmaterialförderung durch Unterdruck Seite 154
Eine pneumatische Förderanlage für Graphit wird beschrieben und abgebildet. Mit der Einführung dieser Anlage wird der Transport des Graphits vom Bunker zur Fertigungsstelle von Hand überflüssig gemacht. Die Anlage arbeitet wirtschaftlicher und schaltet störendes Stauben aus.

Paketförderung Seite 156
Von J. W. Leech
Ein Überblick über die vielen verschiedenen Fördergeräte, die z.Zt. für das Fördern und den Umschlag von Paketen, Kästen, Schachteln, Flaschen u. dgl. zur Verfügung stehen.

Neuer Frachtdienst für Einheitslasten Seite 165
Bericht über die Eröffnung einer neuen Schiffsverbindung zwischen Liverpool und Belfast. Die Schiffe sollen speziell für den Transport von Einheitslasten eingesetzt werden, und Spezialbehälter aus Aluminium mit einem Fassungsvermögen von 12 t sind für den Warentransport von Tür zu Tür vorgesehen.

Ein vielseitiger Schlepperschaufellader Seite 167
Demonstrationsbericht über eine imposante Leistung der Radschlepper-Ladeschaufel 'Matbro Mastiff'. Die ausserordentlich gute Wendigkeit und Übertragung der Zugleistung sind charakteristische Merkmale einer wirklich durchdachten Konstruktion.

Elektrotechnische Ausstellung Seite 171
Eine Vorschau über einige der Geräte und Anlagen, die auf der vom 17. bis zum 21. März in Earls Court in London stattfindenden elektrotechnischen Ausstellung zu sehen sein werden.

Persönlichkeiten in der Industrie Seite 174

Neue Geräte Seite 175

Branchennachrichten Seite 180

Neueingänge Seite 183

Auszüge und Schrifttum Seite 183
Artikel über Materialfluss und Förderwesen aus Fachschriften in aller Welt werden in diesem Artikel angeführt und kurz besprochen.

Neue Patente Seite 185

SUMARIO EN ESPAÑOL

Electroimanes portadores en ayuda de las construcciones navales Pág. 126
Por un miembro del cuerpo de redactores
Este artículo describe un nuevo tipo de electroimán portador ligero, construído de piezas en lugar de ser de fundición, y que está ahora en uso en tres astilleros británicos. Como el peso de estos imanes es 50 por ciento menos que el de los fundidos, ofrecen especiales ventajas cuando se usan varios de ellos juntos con una viga de extensión (como en el manejo de grandes chapas de acero), ya que al trabajar de este modo la capacidad de la grúa es mucho menos absorbida por el peso de los electroimanes, quedando una proporción mucho mayor para carga útil.

Taller de pintura mecanizado Pág. 129
Descripción, con ilustraciones, del equipo instalado para la aplicación mecanizada de pintura a los automóviles en una fábrica de montaje sudafricana.

Transportadores y elevadores no fijos. Parte 15 Pág. 133
Por J. M. Beskine, B.Sc.(Eng.)

La mecanización de los puertos : Sus problemas y ventajas Pág. 138
Esfuerzo por atraer la atención sobre la necesidad de mecanizar el movimiento de la carga para abreviar el tiempo de rotación de los y atraer mayor actividad a nuestros puertos antes de que sea tarde.

El movimiento de materiales de la fábrica del futuro Pág. 141
Por un miembro del cuerpo de redactores
Es éste el segundo de dos artículos en los que se pasa revista a las instalaciones exhibidas en la reciente Exposición de Calculadoras Electrónicas de Londres.

Nomograma que simplifica la especificacion del ancho en las correas transportadoras Pág. 145

Servicio para tractores Pág. 146
Por K. Mumby
Informe resultante de una investigación de las facilidades que proporcionan a los usuarios de tractores oruga los departamentos de servicio y de piezas de la casa Leverton of Leeds, Ltd.

Carretones en los puertos del Africa Oriental Británica Pág. 153
Breve informe sobre el empleo de los carretones de horquilla elevadora y de plataforma en los cinco puertos del Africa Oriental Británica.

Transporte de materias primas por el vacío Pág. 154
Sistema de transporte neumático para el movimiento de grafito, con descripción e ilustraciones. Se trata de una instalación con la que se ha suprimido el movimiento del grafito a mano desde el almacén a las líneas de producción y elaboración. Se ha logrado mayor eficiencia en la manipulación y se ha eliminado el gran inconveniente del polvo.

Movimiento de paquetería Pág. 156
Por J. W. Leech
Revista de los muchos tipos diferentes de transportadores que existen actualmente para manipular paquetes, cajas, envases de cartón, botellas y artículos análogos.

Nuevo servicio de flete para cargas unitarias Pág. 165
Informe sobre la inauguración de un nuevo servicio de transporte marítimo entre Liverpool y Belfast. La construcción de los barcos es específicamente para el transporte de cargas unitarias, habiendo unos recipientes especiales de aluminio cuya capacidad es de 12 toneladas para el transporte de las cargas de puerta a puerta.

Una pala a tractor de gran flexibilidad Pág. 167
Informe demostrativo de la impresionante actuación de la cargadora-tractor a ruedas 'Matbro Mastiff'. Una maniobrabilidad excepcional y una gran eficiencia en la transmisión del esfuerzo de tracción demuestran por qué este diseño ha sido un éxito completo.

Exposición de Ingenieros Electricistas Pág. 171
Examen anticipado de algunos de los elementos que se exhibirán en la Exposición de Ingenieros Electricistas que se celebrará en Earls Court (Londres) del 17 al 21 de Marzo.

Noticias sobre personalidades Pág. 174

Revista de los equipos que constituyen novedad Pág. 175

Notas del ramo Pág. 180

Publicaciones recibidas Pág. 183

Extractos y referencias Pág. 183
En esta sección vienen clasificados los artículos sobre manipulación mecánica publicados en las revistas técnicas e industriales de todo el mundo, haciéndose constar un extracto de los mismos.

Patentes de fecha reciente Pág. 185

LIFTING MAGNETS AID SHIP CONSTRUCTION

Light-weight magnets enable heavier payloads to be lifted

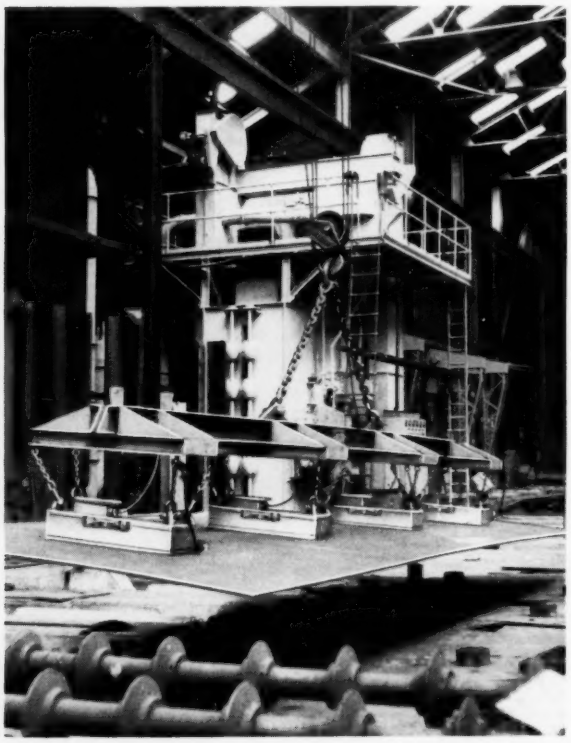
By a Staff Contributor

A NEW TYPE of lifting magnet is now being used by three shipbuilders in the United Kingdom for the handling of large steel plates for ship construction. The magnets have been especially developed for this and similar duties by Electromagnets, Ltd., of Boxmag Works, Bond Street, Birmingham, 19. The users are Harland & Wolff, Ltd., of Belfast, The Blythswood Shipbuilding Co., Ltd., of Glasgow, and Bartram & Sons, Ltd., of Sunderland.

At the works of Bartram & Sons, Ltd., the lifting magnets are chiefly employed for the positioning of large plates on a roller table which enables them to be fed to a Monopol flame-cutting machine. They are also used at this works for feeding plates to a large shot-blasting plant (Fig. 1) and to an optical marking device (Fig. 2) used for developing the required contours of the plates.

At the Blythswood Shipbuilding Co., Ltd., the magnets are used for handling plates in the stockyard (Fig. 3) while at Harland & Wolff, Ltd., they are used, as at the works of Bartram & Sons, Ltd., for feeding plates to and from the shot-blasting plant.

Fig. 1. Lifting magnet assembly handles plates to shot blast machine, seen in background, at the shipbuilding works of Bartram & Sons, Ltd. The magnets also handle plates to and from roller table, part of which is seen in foreground, for feeding to Monopol flame-cutting machine



Magnet Construction

The magnets differ from normal lifting magnets in that they are of fabricated instead of cast construction. This has enabled the weight of each magnet to be reduced to the minimum. As a result, much less of the actual crane capacity is taken up by the weight of the magnet. This weight-saving is particularly advantageous when lifting large plates which call for the use of several magnets mounted on a spreader beam (as shown in the accompanying photographs) to provide stability in lifting the plate and to avoid the danger of buckling the material. In normal circumstances the added weight of these multiple magnets would seriously reduce the effective capacity of the crane. The new fabricated magnets, however, weigh 50 per cent less than the cast magnets, showing a very appreciable gain in effective crane utilization when five or six magnets are used together. A typical layout for this type of equipment on an overhead travelling crane is seen in Fig. 5, the whole assembly being suitable for shipyards or steelworks, for indoor or outdoor use. A close-up of a typical magnet is seen in Fig. 4.

Load Selection

The magnet assembly is used in conjunction with the company's patented Select-O-Load system, which enables plates to be picked up one at a time from the top of a stack. Selective discharge of one or more plates from the magnets' load can also be readily achieved.

This is accomplished by means of a potentiometer which regulates the supply of current to the field of the generator providing the power for the magnet assembly, thus enabling the generator output to be varied from zero up to full voltage. In this way the lifting capacity of the magnet can be varied according to the load.

Use of a generator instead of a small number of series resistance banks means that only relatively small currents (i.e., the generator field excitation current) are handled by the potentiometer. Besides affording greater economy in operation, this arrangement provides a large number of resistance steps within a comparatively small space, thus giving a wide variation in lifting capacity.

Multiple magnets mounted on a spreader beam can be provided with separate conductors to each magnet, the conductors being wired to a bank of selection switches, thus allowing the operator to utilize only the magnets required to span a particular size of plate. This arrangement (which eliminates the need for a spreader beam with adjustable centres) is essential where plates of varying sizes are stacked on top of each other.

Safety System

An auxiliary safety system can be provided, consisting of a set of batteries and automatic control gear which enable the magnets to retain the load for 15 minutes in the event of a mains current failure, giving sufficient time to inch down the

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Fig. 2. Another view of the lifting magnet assembly handling plates at the shipbuilding works of Bartram & Sons, Ltd. The optical marking device is seen in the left background

Fig. 3. Handling plates with a lifting magnet assembly in the stockyard of the Blythswood Shipbuilding Co., Ltd.

Fig. 4. Close-up view of one of the magnets mounted on a spreader beam at the works of Bartram & Sons, Ltd.

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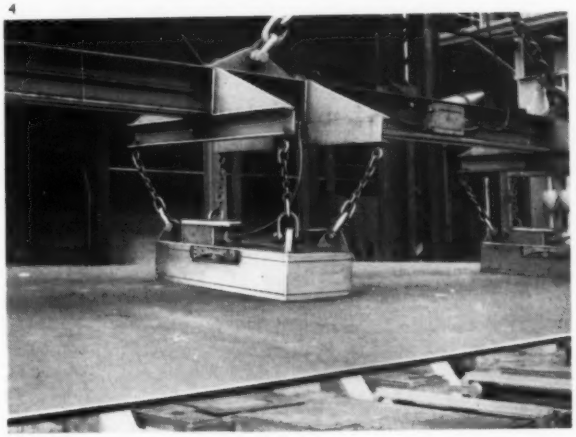


load. An alarm bell is also incorporated to give an audible warning of any mains failure.

Method of Operation

In operation, the magnet assembly is lowered on to the plate it is desired to lift, and the controller is set to a predetermined position permitting the generation of a field in the magnet which is sufficient to lift the required plate or plates, but not any beneath them. When it is desired to release one plate from beneath a load consisting of a number of plates, the field of the magnet is reduced by inching the controller until the plate is released. Very little practice is needed to make the operator skilled in the use of this equipment.

Handling Capacity

The manufacturers' specification for the fabricated plate-lifting magnets is given in Appendix 'A' and in Table I. The latter gives details of the three standard plate-lifting magnets now in production. Some idea of the handling capacity of these magnets may be gained from the fact that an assembly of five magnets, Ref. SLM5012, will handle plates of up to 45 ft in length × 12 ft in width × 1½ in thick. Five SLM3612 magnets will handle plates of up to 40 ft × 10 ft × 1½ in thick, and four magnets, Ref. SLM3612, will handle plates of up to 30 ft × 10 ft × 1½ in thick.

Select-O-Load Specification

The Select-O-Load generator is a special type of direct

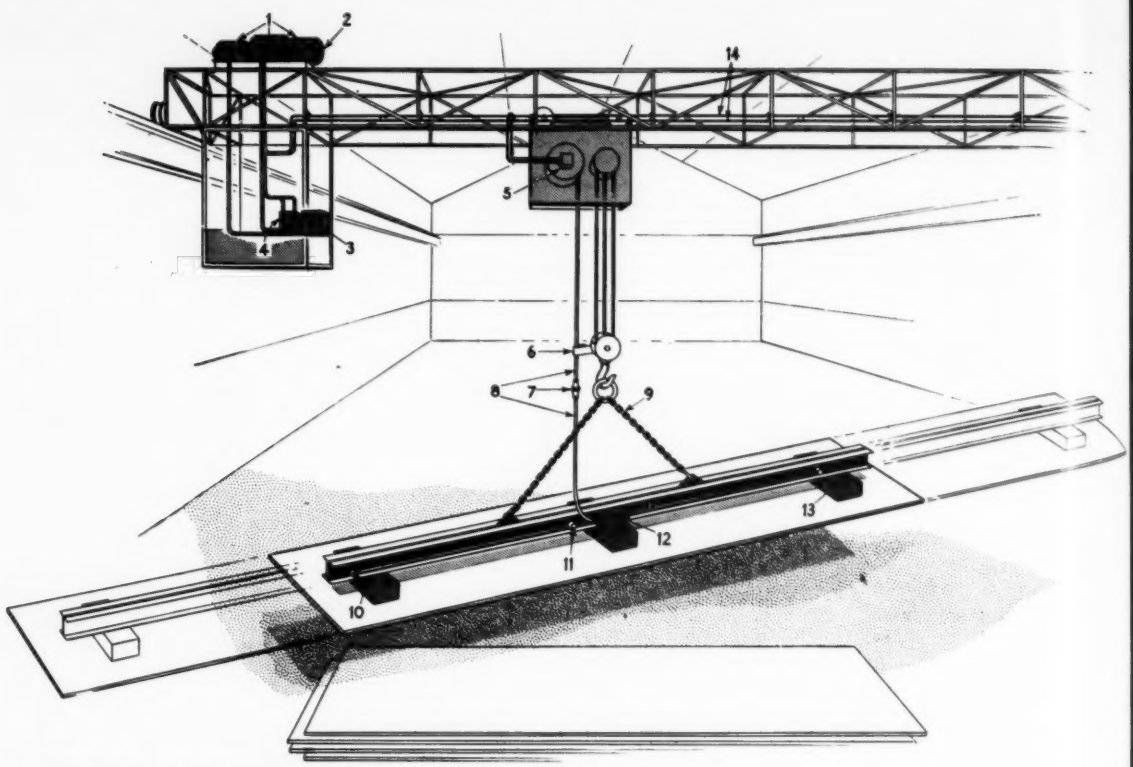


Fig. 5. Typical layout for lifting magnet assembly mounted on spreader beam and with Select-O-Load control

KEY

1 Motor generator set, consisting of exciter, generator and motor
2 A.C. supply to motor
3 'Select-O-Load' controller
4 Selector switch for individual selection of magnets
5 Spring-operated cable reeling drum fitted to traversing trolley or crane crab
6 Cable clamp (normally supplied and fitted by user)
7 Niphan connector
8 Flexible 3-core transmission cable (multicore cable if individual selection of magnets is required)
9 Twin-legged sling chains
10 Each magnet fitted with Niphan plug on flexible transmission lead
11 Conduit entry type base-mounted sockets for magnet supply
12 Junction box fitted to beam. Steel conduit to sockets
13 Suspension lugs on magnets
14 D.C. supply cross wires from generator. When individual selection of magnets is required, the number of D.C. supply cross wires will be increased accordingly.

Table 1. Details of the new fabricated plate-handling magnets

Magnet Ref.	Length in.	Width in.	Height in.	Current Consumption	Net Weight	Max. pull on 1½ in plate
SLM.2412	24	12¼	7	1·1 kw	410 lb	3 tons
SLM.3612	36	12¼	7	1·62 kw	616 lb	6 tons
SLM.5012	50	12¼	7	2·1 kw	860 lb	9 tons

electric current generator in which the supply of current to its field is regulated by the potentiometer controller. The generator may be driven by any suitable prime mover. Usually this is an electric motor adapted to operate on either a direct current or alternating current supply. The supply of current for the field generator may be taken from a D.C. mains supply or be provided by a separate exciter.

The Select-O-Load controller is a specially designed multi-step reversing potentiometer robustly constructed so as to be suitable for steelworks and shipyard use. It is fitted with an operating lever to which is attached a pointer, both of which traverse a segmental scale indicating the appropriate operating positions which include 'Drop', 'Off', 'Lift', and 'Flush'.

Between the 'Off' and 'Lift' positions are 42 intermediate positions which may be calibrated from zero to 100 per cent of the rated lifting capacity of the magnets. The 'Flush' position provides a momentary flush voltage giving increased lifting capacity which is maintained at the normal working voltage. The 'Drop' position allows the application of a small percentage of the full voltage in the reverse direction to the magnet coils, thereby neutralizing any residual magnetism remaining in the core of the magnet or in the load, and ensuring instant discharge.

APPENDIX A—*Specification of fabricated plate-handling magnets*

Magnet Shells are of combined welded and bolted construction from high permeability steel plate. The poles are formed in the construction to create a multi-directional field.

Magnetizing Coil. Several coils are embodied in the magnet dependent upon the length, and are wound from high conductivity copper wire, fireproof insulated and capable of withstanding a pressure of 1,000 V between turns. The coil is wound on to bobbins integral with the cores.

Coil Cover. This forms part of the coil bobbins and is located to protect the coil from damage. An additional protection is by hard non-magnetic filling between the poles which also prevents field shorting by scale from the surface of the plates which would otherwise solidify in the air gaps.

Terminal Box is fabricated integral with the Magnet Shell and is of the totally enclosed type housing a terminal board fitted with large terminal screws. A waterproof gland for cable entry is incorporated. The lid is designed to protect the cable entry gland from impact damage by sling chains.

Sling Chains are of the two- or four-legged type manufactured from best quality forged steel.

Cable and Coupling. A length of TRS cable is fitted, together with a suitable waterproof cable coupling.

New Installation at South African Motor Assemblers & Distributors Ltd.

MECHANIZED PAINT SHOP FOR MOTOR VEHICLES

VOLKSWAGEN and Studebaker vehicles received in a completely knocked down condition are assembled in the Union of South Africa by South African Motor Assemblers and Distributors (SAMAD) at Uitenhage. Recently the firm has extended its premises so that it is now one of the largest and most modern in the Union of South Africa.

The most important project in the £500,000 extension plan just completed was the building of a new paint shop which sets a new standard in body finishing practice, and which, it is stated, contains the largest paint dip tank in the Southern hemisphere. The plant was officially opened recently by Dr. Otto du Plessis, Administrator of the Cape Province.

The complete paint shop was designed and manufactured by The Incandescent Group, manufacture and installation being the sole responsibility of the Incandescent Group (South Africa) (Pty.), Ltd.

The flowline is illustrated in the diagrammatic sketch, Fig. 1, and comprises the process sequences as described below. The numbers in brackets refer to the stages marked on Fig 1. Fig. 2 shows the interior of the shop viewed from point (33).

The body is transferred from the body shop (1) in an adjoining building by means of an overhead conveyor. At (2) it is transferred to a twin-chain flight bar conveyor with intermittent operation, the progress of which is regulated automatically at 4·8-min intervals. The subsequent progress of the body is as follows.

Phosphating and Prime Coat Section

This section is shown in the sketch by Nos. (2) to (11), and is approximately 370 ft long. It is fully automatic, except for the dipping operation when the body is fully immersed in the paint tank. This complete line is served by two intermittent flight bar conveyors, both of which are synchronized to work in conjunction with the doors and pumps of the phosphating plant, and the doors on the two ovens.

Each section in this line is divided into 20-ft stations and bodies remain in each station for a period of 4·8 min, before moving to the next station. The various compartments in this section are:—

(2) Loading deck

(3) Alkali degrease (spray) at 160 deg F.

(4) Cold rinse (spray).

(5) Spray phosphate at 140 deg F (shown in cross-section in Fig. 3).

(6) Hot rinse with $\frac{1}{20}$ % chromic acid at 130 deg F (spray).

(7) Blow-off station.

(8) Three-stage indirect oil-fired dry-off oven.

(9) Transfer station, where the body is lifted from the slat conveyor by means of an overhead air-operated hoist, ready for dropping into the prime paint dipping plant.

In each section of the pretreatment unit, between the opening and closing of the doors, the pumps are in action for approximately 2½ min, and then stop, draining taking place until the doors open. The dry-off oven, approximately 60 ft long, is a three-stage unit, and is heated by air circulation, the heating medium being indirect oil-fired heaters burning light diesel oil; oven temperature up to 400 deg F.

(10) Prime dip tank (Fig. 5). This is the only dip tank in South Africa exclusively used for the complete dipping of the car body shell. The tank is approximately 22 ft long by 9 ft deep by 8 ft wide. In normal operation the tank is filled with 9,000 gal of paint. To make certain that there is no resettlement of the paint two recirculating pumps have been installed, one to stand by should the other one fail.

(11) Three-stage draining section. When completely covered with paint the body shell is lifted from the tank and placed on the second slat conveyor, and surplus paint runs off into the drain trays. This section, together with

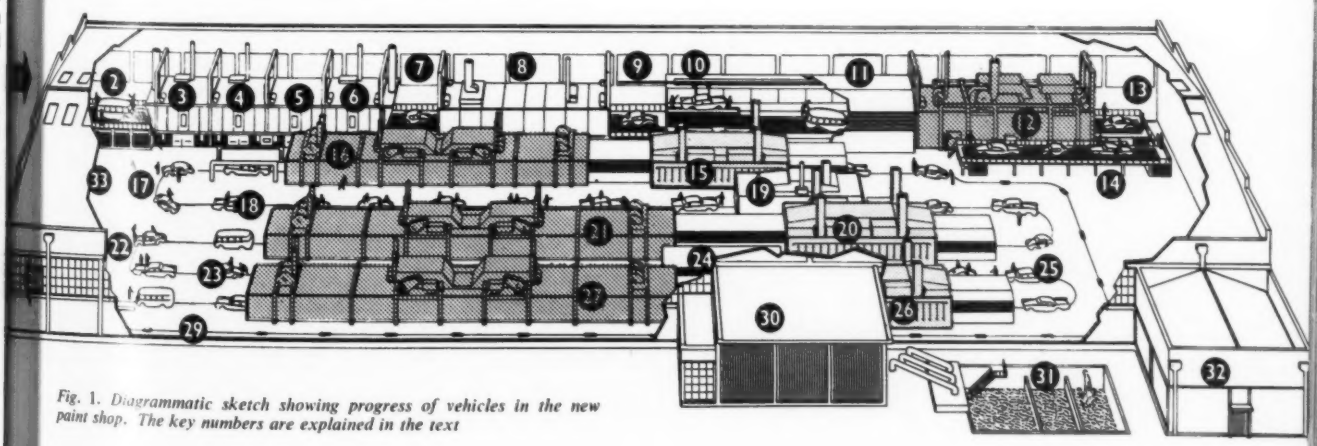


Fig. 1. Diagrammatic sketch showing progress of vehicles in the new paint shop. The key numbers are explained in the text

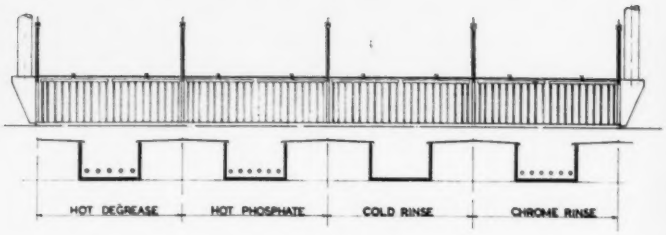


Fig. 4. Side elevation of spray bonderizing plant

the dip tank area, is completely enclosed by means of a canopy constructed of steel sections, steel sheeting, and reinforced glazing to obtain as much natural light as possible.

The object of this canopy is to confine the volatiles within this area. Filtered fresh air is supplied by an input fan, blanketing down air over the dip and drain section, and the heavy fumes are extracted by an exhaust fan connected to ducting running underneath the steel grid walkways on either side of the dip and drain section.

As the above section represents a major fire hazard, the following safety precautions have been taken.

(*a*) A carbon dioxide distribution station over the whole dip and drain section has been installed.

(*b*) A paint dump tank, beneath the ground outside the paint shop, but adjacent to the dip tank has been installed.

In the event of fire, the carbon dioxide is brought into commission, either manually or automatically, blanketing the dip tank and drain section with carbon dioxide gas. At the same time as the gas is released, two large valves are automatically opened in the bottom of the dip tank, draining the paint into the dump tank, thus preventing a serious fire and also saving the paint from excessive damage.

Prime Bake Oven (12)

This is a three-stage oven 60 ft long, heated by air circulation, the heating medium being an indirect oil-fired heater designed to burn light diesel oil. Vertical sliding doors, automatically operated, are fitted to this oven, as on the phosphate and water dry-off ovens previously described.

High-Level Conveyor (13 and 14)

When the body is delivered from the prime bake oven, it is lifted by an air-operated hoist on to a high-level conveyor, which is approximately 70 ft long and 7 ft high. The construction of this conveyor is similar to the slat conveyor running through the phosphating section, but in this instance is running continually at a speed of 5 ft/min. The reason for this conveyor being at high level is for easy access by the operator to supply a sound deadener and sealer.

From the high-level conveyor, the body is lifted by an air-operated hoist and placed on the floor conveyor (29) which conveys the body through all subsequent operations, i.e. spray booths, baking ovens, flatting decks and inspection points. Fig. 6 shows the shop viewed from near (14).

Spray Booths (15, 20 and 26)

There are three spray booths (cross-section Fig. 7), constructed in identically the same manner. Each booth is served by a 20-ft tack-off section, and approximately 30 ft flash-off sections. Each booth has four extraction fans, capable of exhausting a total of 72,000 c.f.m. This exhaust air is scrubbed by means of water sprays in baffled ducting, before being passed to atmosphere, thus ensuring that no paint fumes or overspray are thrown outside. Each spray booth has its own water pump, driven by a 75-h.p. motor,

Fig. 2 Interior of new paint shop from point (33), *showing left: Bonderizing, paint dip and drain sections; centre and right: spray booths and baking ovens*

and capable of delivering 2,000 gal of water per minute. All three pumps are situated outside the paint shop.

Reinforced Concrete Tank (31)

A reinforced concrete tank 50 ft by 40 ft, with a capacity of 60,000 gal of water, has been constructed outside the paint shop. Adjoining this tank, three pumps pump the water through 12-in pipelines to the spray booths, and the water then gravitates back to the tank through a common large-diameter pipe.

Overspray carried through the spray booth back to the recirculating tank is removed from the water by two banks of coke filters before the water is pumped back for further use.

To replace all the air exhausted from these three booths, the following equipment has been installed in a separate filtration building.

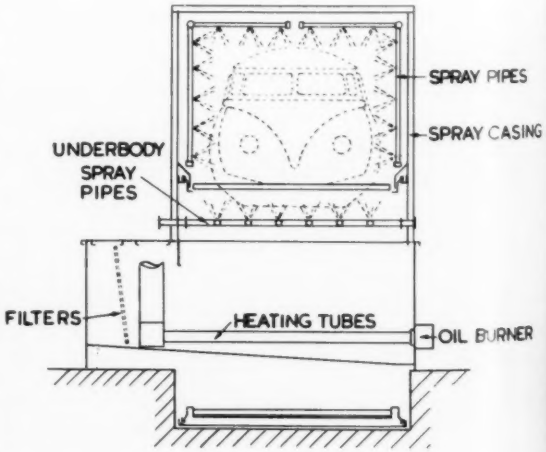
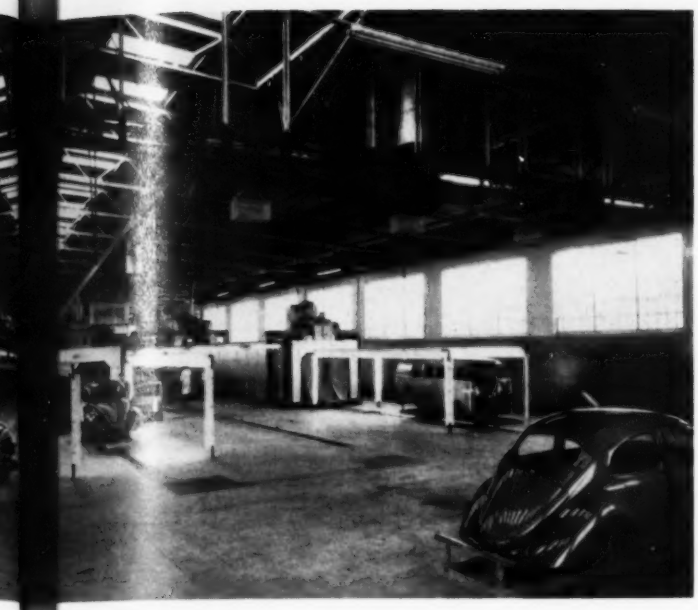


Fig. 3. Cross-section of spray bonderizing plant



(*a*) Three input fans driven by 45-h.p. motors, each capable of delivering 80,000 c.f.m.

(*b*) Three banks of electrostatic filters working at 20,000 V which remove all the dust particles from the air before it is delivered to the spray booths by means of large overhead ducts. These ducts are approximately 30 ft square in cross-section and have been fabricated from light galvanized sheet metal. A downward air flow is maintained over the car body being painted. The air passes through a grille and across the water surface to the baffle plates in the towers where a water spray thoroughly cleans it.

The air speed in the booth is approximately 120 ft/min, and to maintain a state of plenum in the booth, the inlet of conditioned air is about 10 per cent greater than the booth extraction.

Baking Ovens (16, 21 and 27)
Three paint-baking ovens have been installed immediately following the flash-off sections. Each oven is over 100 ft long and each has two zones for heating, through which air is recirculated round heat exchangers (shown in Fig. 8) before entering the ovens. All three ovens are fitted with air seals at each end to prevent hot air from leaving the oven area, and keeping cold air out.

The three ovens, as mentioned above, are heated by air circulation from heat exchangers, the fuel being light diesel oil.

Flatting Decks (18 and 23)
On the flatting decks (18) and (23) two 40-ft long ovens (19) and (24) have been installed for drying off any moisture that might be left on the body after the wet-sanding operation. Both ovens are direct oil fired. No heat exchangers and air seals have been fitted, as the ovens are only drying off water.

Inspection Points (17 and 22)
Inspection points are located at (17) and (22) and at a point just before the body leaves the paint shop for the trim line (28). At these points, inspectors examine the body very carefully for blemishes; bodies that do not pass inspection are returned to the appropriate section. Fig. 9 shows the inspection area (22) with flatting deck (23) and dry-off oven (24) in middle background.

General Layout
The main building of the new paint shop covers an area of approximately 60,000 sq. ft., and is separate from the main assembly buildings.

Working in conjunction with this job are a paint mix building (32), 1,600 sq. ft. in area, and a paint store also

Fig. 5. Paint dip tank viewed from point (6)

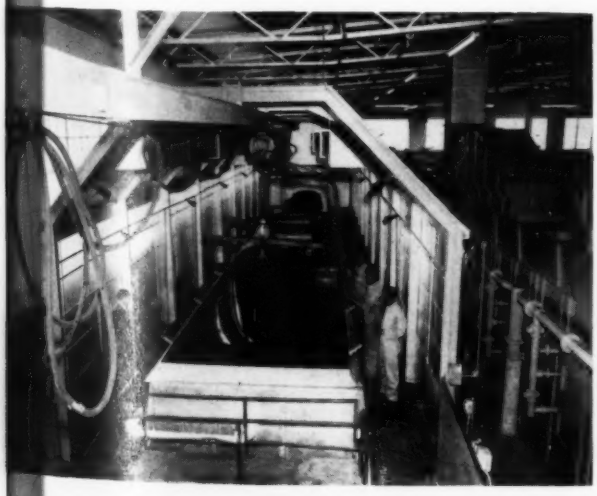


Fig. 6. Interior of paint shop from point (14). *The high-level conveyor on the right; Centre: bodies leave dry-off oven* (19) *and enter spray booth* (20)

1,600 sq. ft., which, due to the highly volatile liquid stored in it, is approximately 300 ft away from the main building.

The air filtration building (30) adjoins the paint shop and is approximately 1,500 sq. ft. in area. This building is used solely for the housing of the equipment supplying clean filtered air to the three body spray booths (15), (20) and (26).

Between the filtration building and the paint mix building is a large open-top concrete water tank (31), as described above.

Details of the Main Building

This building is constructed of reinforced concrete columns, with brick and reinforced glazing between the columns.

All the windows are non-opening and the roof is completely sealed to ensure that no dust can enter.

Ventilation is by means of ten input fans, complete with filter box situated in the roof over main working areas and ducted down to approximately 16 ft from the floor.

The hot foul air rises to the roof and escapes through an adjustable ridge ventilator which is 380 ft long.

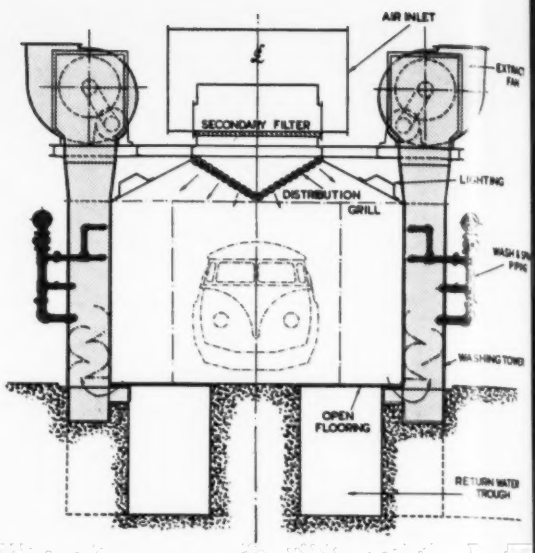


Fig. 7. Cross-section of spray booths (15), (20) and (26)

ABOVE
Fig. 9. Spray booths and inspection areas, from point (28)

BELOW
Fig. 8. Heat exchangers on paint-baking ovens.

To prevent dust from rising from the floor, due to trolleys passing around the conveyor track, a special ferrous salt was added to the top dressing of the concrete, and not only does this prevent dust, but it also obviates having to sink special guide tracks into the floor on which the body trolleys normally run, as this surface is extremely hard.

Conveyor System

The paint shop is served by a system of conveyors which carry the body shell during the entire painting system. An overhead conveyor (1) brings the body in from the body shop and returns carrying the finished painted body back to the trim line (28).

Overhead tunnels were constructed between the main assembly building and the paint shop, to carry the body conveyor. There is also a light duty conveyor (33) to handle the small parts requiring painting. This small parts conveyor winds right through the main plant, commencing at the unboxing area adjoining the railway siding. Unpainted parts are loaded on to the conveyor and are carried overhead to the paint shop, where they are painted, and loaded back on to the conveyor for distribution to the assembly lines. This conveyor is approximately 1,800 ft long and can be adjusted to run at speeds between 2 and 6 ft/min by means of an electronic control panel situated within the paint shop.

As mentioned above, through the Bonderite plant (3), (4), (5) and (6) and the paint drain and bake section (10), (11) and (12), the bodies are conveyed by means of two intermittent flight bar conveyors. The first conveyor operates between the loading platform (2) and platform (9) next to the paint dip tank. The second conveyor starts at the rear end of the paint dip tank (10) and runs to the transfer deck (13) at the end of the prime bake oven.

For convenience and ease of operation, there is a short overhead flight bar conveyor, carrying the car bodies through section (14) where the sound deadener and underbody sealers are applied.

To carry the body shells from the various spray booths, ovens, flashing decks, etc., there has been installed a single-strand conveyor with an approximate overall length of 2,050 ft, and which is variable in speed from 1 ft 6 in to 5 ft/min, according to the rate of production flow required.

All conveyors were manufactured by George W. King, Ltd., of Stevenage.

A survey of mobile conveyors and elevators, portable and transportable conveyors, and similar equipment — Part 15

'NON-FIXED' CONVEYORS AND ELEVATORS

by J. M. Beskine, B.Sc.(Eng.)

A WIDE RANGE of mobile band conveyors, vehicle loaders and roller conveyors is manufactured by A. L. Marshall (Carlton), Ltd., who also manufacture a variety of standard and custom-built permanent conveyors and elevators of many different types.

The mobile conveyors manufactured by this firm consist, basically, of the following types; (*a*) fixed height band conveyors and vehicle loaders; (*b*) variable height band conveyors; (*c*) variable height chain slat conveyors; (*d*) conveyors which are capable of acting as variable height horizontal conveyors, or as variable height inclined conveyors or elevators; (*e*) general-purpose and special-purpose horizontal band conveyors; (*f*) retractable gravity roller conveyors. All these machines are described in the review which follows.

'Pacemaker' Conveyor-elevators

The 'Pacemaker' variable height mobile band conveyor-elevator is one of the most versatile and popular mobile conveyors. Figs. 212 and 213 illustrate the Mark I 'Pacemaker' conveyor, which is employed for road and railway vehicle loading and unloading duties in many different industries as well as general stores and warehouse duties and inter-process handling in industry generally.

This conveyor is hydraulically elevated by means of a single centrally mounted jack, which is manually operated. It is very manoeuvrable and can be used as a variable height horizontal conveyor, or as a variable height inclined conveyor or elevator. It has an 18-in rubber-covered grip-face band which runs on a roller base. It is electrically driven and is instantly reversed by push-button control. The conveyor has a boom length of 13 ft 5 in and it has a maximum delivery height of 7 ft 3 in which corresponds to a feed height of 11 in at an inclination of 30 deg. The minimum delivery height is 2 ft 7 in. When arranged as a horizontal conveyor, the machine has a minimum height above ground level of 2 ft 7 in and a maximum height above ground level of 3 ft 6 in.

The Mark I 'Pacemaker' conveyor-elevator has a band speed of 85 ft/min, a distributed load capacity of 2 cwt and weighs only 7 cwt. The machine employs a tubular steel cradle framework and it is mounted on 16-in dia rubber-cushion-tyred front wheels and swivel-type 6-in dia rear castors with bonded rubber tyres. It is stabilized by means of a very easily operated stabilizer handle, positioned at the side of the machine, as shown in Fig. 214, and is a well-balanced and easy-to-handle multi-purpose mobile conveyor.

Fig. 212 shows a Mark I 'Pacemaker' at maximum delivery height, as seen from the hydraulic control side of the machine. Fig. 213 shows such a machine loading a railway van with cartons of electric lamps. Fig. 214 shows a machine arranged as a horizontal conveyor at maximum height above ground level, and Fig. 215 shows the same machine as a horizontal conveyor at minimum height above ground level.

Fig. 212. ALM Mark I 'Pacemaker' mobile band elevating conveyor, which is widely employed for van and lorry unloading, stores duties and inter-process handling. Shown at maximum delivery height, 7 ft 3 in

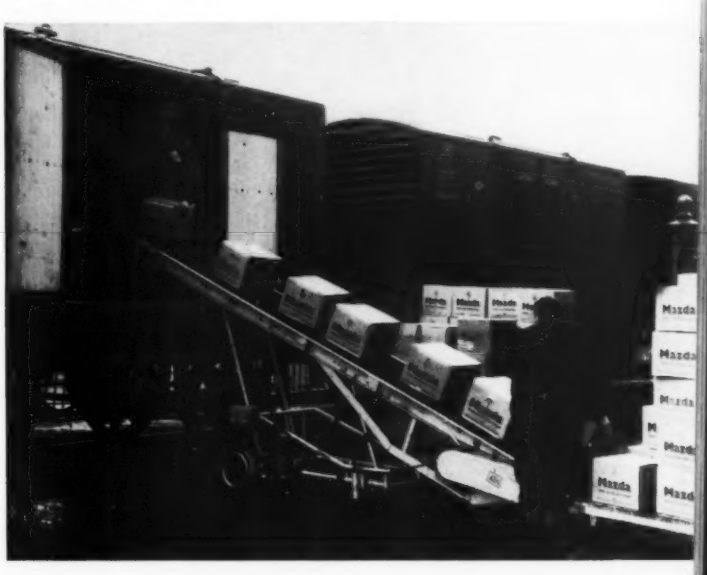


Fig. 213. ALM Mark I 'Pacemaker' mobile conveyor at work, loading a railway van with packaged electric lamps. Note combined use of a mobile conveyor and four-wheeled hand truck or trailer, to improve flexibility of vehicle loading

Fig. 214. ALM Mark 1 'Pacemaker' mobile conveyor arranged for horizontal conveying at maximum height above ground level, 3 ft 6 in

Fig. 215. ALM Mark 1 'Pacemaker' mobile conveyor arranged for horizontal conveying at minimum height above ground level, 2 ft 7 in. This machine has a hydraulic single-jack elevating system

Fig. 216. ALM twin-jack portable conveyor-elevator available in a range of sizes, with 16 ft as the maximum delivery height. Note use of span-mounted driving head to permit extra depression of loading end

Fig. 217. ALM twin-jack portable conveyor with side angles. Note use of orthodox-positioned driving head, as compared with arrangement in Fig. 216

Fig. 218. ALM twin-jack portable conveyor-elevator, with metal lifters

Other ALM Variable Height Conveyors*

In addition to the 'Pacemaker', A. L. Marshall (Carlton), Ltd., also manufacture twin-jack machines, and a typical example is shown in Fig. 216. This twin-jack portable conveyor is available in a range of boom lengths, the largest machine in the range being able to elevate to a height of approximately 16 ft. Other twin-jack conveyors are shown in Figs. 217 and 218. The machine shown in Fig. 217 is fitted with side angles and that shown in Fig. 218 is fitted with metal lifters.

Comparison of Figs. 212, 216, 217 and 218 is of interest. It will be seen that these ALM portable conveyors have slightly differing layout arrangements for their driving and band tensioning units. This variation is designed to provide the best arrangement for each boom length and required minimum loading height. A. L. Marshall (Carlton), Ltd., have wide experience of mechanical handling in practically all industries and have great expertise in the art of combining specific handling requirements with standardized manufactures.

A number of other types of variable discharge height conveyors are made. Most interesting of these is the new tubular steel range of ALM mobile band conveyors. A typical example is illustrated in Fig. 219. As can be seen, tubular steel construction is employed for the conveyor boom and for the simple under-carriage arrangement, which incorporates hydraulic jacks for height adjustment. The

* The initials ALM are employed as a trade mark by A. L. Marshall (Carlton), Ltd.

Fig. 219. ALM new conveyor-elevator, tubular steel construction, variable discharge height. Length of boom is 21 ft. Other models in this range have boom length of 15 ft to 30 ft in 3-ft stages

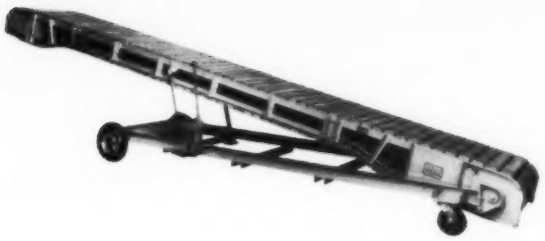


Fig. 220. ALM portable chain and wood slat conveyor, variable discharge height, suitable for heavy duty. This incorporates twin hydraulic jack height adjustment. The conveyor can be lowered for low height horizontal conveying duties

whole design is particularly neat and economically designed, structurally. Because of this fact, and the very good inherent balance of the machine, the new tubular conveyor-elevator is light to handle and easily manoeuvrable when working in awkward locations. Cushion or pneumatic-tyred main wheels are employed, and at the rear end there is choice of a skid or of a three-wheel trolley.

The machine shown in Fig. 219 has a 21-ft boom and a single-lifting hydraulic jack operated by a hand pump. Other models within this range include conveyor-elevators having boom lengths ranging from 15 to 30 ft in increments of 3 ft. Machines with booms longer than 21 ft are fitted with twin hydraulic jacks.

Another interesting type of ALM variable discharge height conveyor is shown in Fig. 220. The boom of this machine can be lowered until it is horizontal providing a low height above ground level. It is a chain and wood slat type machine, as used for a variety of applications in warehouses, factories, docks, and transportation. Height adjustment is by means of twin hydraulic jacks. In addition to the machine illustrated ALM manufacture a large range of other types of mobile variable discharge height slat conveyors.

Inter-process variable discharge height mobile conveyors are another speciality of this firm. Typical examples are shown in Fig. 221. These are short boom length machines for handling duties in press shops and in other machine shops and in processing plants. They are widely employed for the feeding of machines and for the transfering of work in process from press to press or from machine to machine or process to process generally.

This type of mobile conveyor is mounted on two pairs of castors and it is easy to move from one working position to another. Height control, too, is simple and effective, being carried out by tipping the boom to the required degree and securing by simple fixing means.

Fig. 221. Typical ALM inter-process variable height mobile conveyors, as used in press shops and other factory departments. Height control is by tipping the short boom and locking in position

Fig. 222. ALM fixed height inclined mobile conveyor with 7-ft 6-in horizontal extension, as used for van and lorry loading and unloading. This mobile conveyor is reversible and is available in a range of band widths. Load capacity is 2 cwt distributed

BELOW

Fig. 223. ALM band elevator, fixed height, with grip-face band, and 30-deg inclination

ALM Fixed Height Van Loading and Unloading Conveyors

A wide range of fixed height mobile conveyors is made by A. L. Marshall (Carlton), Ltd. This includes standard machines and a variety of custom-built machines designed to suit users' specific requirements. One of the most popular of these fixed height conveyors is the machine shown in Fig. 222. This can be projected into a vehicle during loading and retracted as required. It is reversible, has an overhang of 7 ft 6 in, and is designed to work with lorries and vans having a platform height of up to 4 ft 6 in.

When using the conveyor shown in Fig. 222 the machine is wheeled to the lorry to be unloaded. The horizontal section is at 6 ft 3 in above ground level, i.e. a minimum of 1 ft 9 in above platform height. Loading (or off-loading)

Fig. 224. ALM band conveyor, 40 ft long mobile, horizontal, for paper sacks which must be kept upright during handling. The bright mild steel guide rail can be on either side of the conveyor, and it is adjustable and variable in height. Similar conveyors are available in other lengths and in a range of load capacities

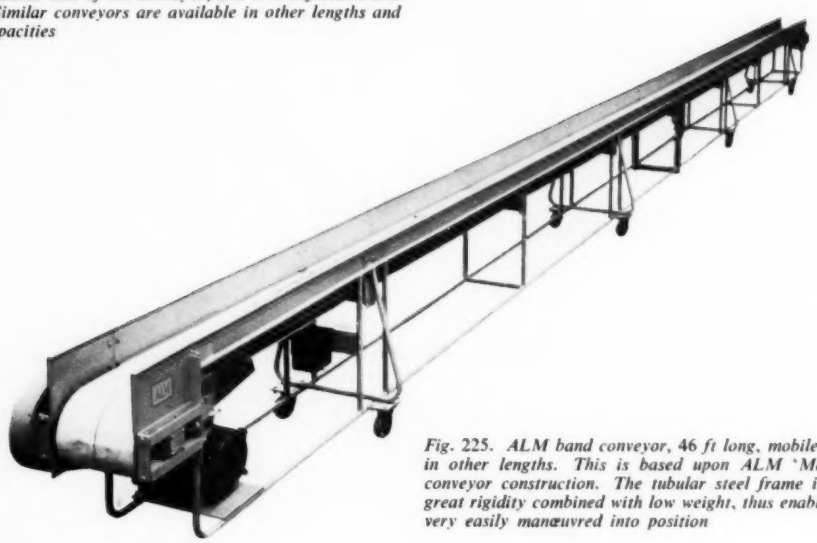


Fig. 225. ALM band conveyor, 46 ft long, mobile, horizontal, available in other lengths. This is based upon ALM 'Masterveyor' unit band conveyor construction. The tubular steel frame is designed to provide great rigidity combined with low weight, thus enabling the machine to be very easily manœuvred into position

can proceed at the end of the delivery section of the conveyor, or along the whole section, according to the size of the vehicle in question and the nature of the load. The load capacity is 2 cwt distributed. A rubber grip-face band is employed and alternative band widths are available. The most popular band widths are 12 in, 18 in and 24 in. As can be seen from the illustration, this type of mobile conveyor is simple in construction. It is rigidly framed and easily manoeuvred at the tailboards of road vehicles.

A typical ALM general-purpose fixed height mobile band elevator is illustrated in Fig. 223. This machine is an extremely simple but highly efficient handling aid and is mainly for use where one inclination and one delivery height is suitable for all handling tasks to be undertaken, or where a machine is working more or less continuously in one position, being wheeled away from time to time for special reasons associated with the nature of the process or the site.

The mobile fixed height machine referred to above has a grip-face band and an inclination of 30 deg to the horizontal. Other ALM mobile fixed height machines are available with other angles of inclination and with a wide range of delivery heights.

ALM Mobile Horizontal Conveyors

Another interesting ALM speciality is the design and manufacture of general-purpose and multi-purpose mobile horizontal conveyors as well as special-purpose machines. As a rule ALM special-purpose machines, horizontal conveyors included, are invariably found to be easily adaptable to other trades and applications. For this reason the machines shown in Figs. 224 and 225 have been selected to represent some of the types of conveyors included in the wide range of ALM mobile horizontal conveyors.

The machine illustrated in Fig. 224 was designed originally for the handling of full paper sacks standing upright. These, in some instances are open at the top although containing various products, and they are conveyed through various processes to sealing machines. The main requirement was to maintain the filled sacks in an upright position, and a subsidiary requirement was that of low loading and low off-loading heights. The latter was achieved by having a very low band height above ground level, the conveyor being supported on a series of castored frames, the number varying with conveyor length. The boom, it will be appreciated, is practically self-supporting.

Experience proved that by use of a polished bright mild steel rail down one side of the conveyor, it was possible to keep the paper sacks upright. This rail can, of course, be mounted on either side of the conveyor, and it is adjustable and variable in height.

This type of ALM mobile horizontal conveyor is available in a range of lengths and load capacities. The machine actually illustrated, for example, is 40 ft in length. Large numbers of such machines are now in use in industry

In some cases a number are arranged to feed each other in series, processing being carried on along the various conveyors. The fact that these conveyors are highly mobile, enables processing set-ups to be modified and rearranged without difficulty.

The mobile horizontal conveyor shown in Fig. 225 is of a different type. It is for inter-process handling in light industry, packing departments, etc. It is 46 ft in length, but is available in almost any practicable length, and in feed and delivery heights to suit specific applications. (Such a conveyor could be made with a reasonable inclination to suit a given site or series of processes.)

The conveyor shown in Fig. 225 is easily manoeuvrable, despite its length. This is because of the employment of tubular steel framework to reduce overall weight and enhance rigidity. As a point of interest, it should be noted that this type of mobile conveyor makes use of ALM 'Masterveyor' unit band conveyor construction, as used on a wide range of fixed conveyors. It can, therefore, be broken down into shorter lengths or lengthened (standard 'Masterveyor' units are of the following lengths, 12, 9, 6 and 3 ft).

ALM Retractable Roller Conveyor

Retractable roller conveyors are amongst the most useful of all mechanical handling devices. They are often ideal for loading and off-loading of vehicles and can be used for a variety of 'flexible flow' applications in factories, warehouses, retail stores, transport depots and docks. They are mounted on castors and can easily be wheeled from one position to another. Being relatively light, they can quite easily be moved from floor level to floor level. They occupy a small space when not in use or when being moved from point to point, because of their ability to be retracted into a fraction of its working length.

ALM retractable roller conveyors are shown in Figs. 226, 227 and 228. These machines are available in units consisting of three 8-ft sections, with 14-in long $1\frac{1}{2}$-in dia rollers at 2-in, 3-in or 4-in pitch. These machines are suitable for the handling of packages weighing up to 100 lb and they are mounted on four adjustable height stands to enable suitable downward gradient to be provided. This gradient can be varied to provide feed height adjustable between 2 ft $8\frac{1}{2}$ in and 4 ft and delivery height adjustable from 1 ft 10 in to 2 ft 5 in according to handling requirements. The stands are mounted on swivel castors having 5-in dia rubber-tyred wheels.

The retractable gravity roller conveyor shown in Fig. 226 is seen in the fully extended position. The overall length in this case is 24 ft and two sets can be used together providing a length up to 48 ft. The rollers are at 4-in pitch in the machine illustrated. Fig. 227 shows the same machine in the retracted position. As can be seen, one of the 8-ft units has two sets of supports mounted on four castors. The other units have one set of supports and two castors each. Fig. 228 shows a typical example of application, in this case, the delivery of groceries from a warehouse to a delivery van. By using two sections only, a gravity roller conveyor 16 ft in length is obtained.

The above outline refers to only a few of the many portable conveyors taken from the ALM range, as there are conveyors available, including troughed band type, for almost all trades and industries.

ABOVE LEFT
Fig. 226. ALM retractable roller conveyor in fully extended position. Overall length is 24 ft. This machine can handle up to 100-lb packages

ABOVE
Fig. 227. ALM retractable roller conveyor in fully retracted position

RIGHT
Fig. 228. ALM retractable roller conveyor in use, loading packaged groceries into a delivery van

PORT MECHANIZATION—THE PROBLEMS AND ADVANTAGES

A plea for greater awareness of the need for mechanized cargo handling to speed the turnround of ships and bring more trade to our ports before it is too late

TODAY'S CAMPAIGN for increased mechanical handling in British ports is not concerted and is frequently misdirected. Many organizations—often with ulterior motives, usually unrelated, all with varying viewpoints—are clamouring loud and long for greater mechanization. Increased mechanization—necessary for attracting greater trade, imperative with the further development of a European Free Trade Area—can only be achieved if vested interests meet together for complete reconsideration of the difficulties and possibilities involved.

It is essential that all sections of the industry, meeting in harmony, must recognize what advantages increased mechanization offers: Quicker quayside working results in faster vessel turnround, attracting greater trade to ports and stevedores, increasing their turnover; cuts shipowners' running costs; improves dockers' working and financial conditions.

The Labour Aspect

Piecemeal handling of this problem, which needs proper co-ordination, has already placed British ports far behind world competitors. Review of progress by overseas harbour boards confirms an opinion that increased mechanization will never be possible until existing labour conditions and port facilities in Britain are improved.

In the 10 years from 1946, the tonnage of seaborne goods handled at the Port of Rotterdam increased from 8 m tons to around 72 m tons; in the same period the tonnage of seagoing vessels using the port increased from 6 m to 43 m. Part explanation of this remarkable progress is the increased use of mechanization through the free-enterprise initiative fostered by the Port Authority.

A yardstick to measure the working of a port is the tonnage of cargo worked per linear foot; 250 tons is the usual capacity for a port. At Singapore, use of over 200 industrial trucks and small gangs keeps the figure at around 320 tons/ft. At

Fork trucks operating on the quayside and in the warehouse can halve the turnround of ships

Pallet trucks perform an extremely useful function in the wings and ends of a ship's hold

Singapore, mechanization was made possible by frequent labour drifts. Labour was not replaced: trucks were introduced. Gang strength was finally cut from 20 to 5—with no objections from the unions.

At the port of Bergen, in Norway, mechanization has halved turnround times for ships. Palletization and trucking permits loading and discharge of over 250 tons of general cargo in less than eight hours. Labour is paid on an hourly basis—gang strength being determined locally between management and employees. No restrictive practices prevail and labour relations are excellent.

In Britain, union leaders appear to accept mechanization only as a supplement to the existing dock labour force. Port authorities and employers claim cuts in gang strength are the first way to justify increased mechanization. Recently, as a result of recessions in world trade, labour surpluses at the docks are running as high as 15 per cent—intensifying resistance among dockers to mechanization.

Existing labour relationships and the surplus of dockers forbid reductions in gangs—prohibit widespread introduction of materials handling equipment.

No one advocates the immediate disbandment of the National Dock Labour Board (although it would save the industry £5 m a year and create a healthier attitude between employer and employee); but the introduction of a pension scheme for dockers over 65 would immediately reduce labour numbers by removing the older element.

By bargaining for a reduced labour force and smaller gangs, in exchange for a pension scheme (long demanded by the unions), mechanization could be speeded up.

This would make for a *smaller* but *more skilled, more highly mechanized* and *better paid* labour force—rescuing British ports from terrible manpower wastages and outmoded handling methods.

Already, in Newcastle, use of 'Worksaver' trucks for handling palletized cargo on Scandinavian ships has increased dockers' earnings from 5s. to 10s. 10d. an hour and the men are now paid the same amount for one day's work as they were previously getting for two. Trucking and palletization of cargo by the North of Scotland Shipping Company at Leith has increased their dockers' hourly rate, through bonuses, by 3s. 6d. an hour.

Unitization of cargo for fork-trucking guarantees men more work: pallets and containers are loaded and unloaded even when ships are not in port. This levels peak work loads and stabilizes employment. At Leith, 22 men work on a semi-permanent basis. In Newcastle, where similar conditions exist, 42 dockers, working Bergen Line ships, are employed on a weekly basis and are guaranteed minimum wage packets.

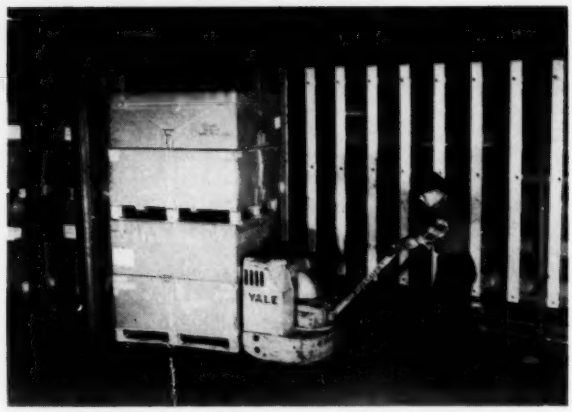
Increased Tonnage Handled

Despite reports of this nature, port operations, where work is almost 100 per cent materials handling, have lagged behind current industrial mechanization. Only in the movement of bulk cargoes, modernized in post-war years, have new handling systems been satisfactorily applied. Change was relatively easy here for two reasons: bulk cargo carriage has grown with many new terminals being built from scratch, often away from established dock areas: and labour content is far smaller than in the movement of general cargo. Great savings in time and transport costs have resulted. Iron ore, grain or coal can be shot into ships and sucked or grabbed out of them at a great rate—1,000 to 2,000 tons/hr. Britain's normal handling rate for *general cargo* (approximately 6-8 tons/hr/hatch) could be increased likewise with industrial trucks and other mechanical handling aids.

In the Great Lakes of Canada, where trucking and palletization are well advanced, 2,000 tons can be loaded in less than 12 hours: an average cargo handling rate of 166·6 tons/hr, the total number of men in the three holds being equivalent to the size of one British gang. Current working rates in Britain with the same gang strength would necessitate a loading time of 333 hours for the same amount of cargo!

Since the introduction of trucking at Newcastle's Tyne Commission Quay, hourly tonnage handled from Bergen and Fred Olsen vessels has been doubled. It is now possible to discharge as much as 18 tons per gang per hour, with an hourly average of 14 tons. Similar increases have occurred

Yale 51 electric fork lift truck handling cargo at Harwich docks



The use of industrial trucks for handling palletized cargo can double dockers' earnings

for Swedish Lloyd ships where about 400 tons of inward and outward cargo are handled each trip. Hourly tonnage figures for this application are 25 tons per gang—as compared with 10 to 12 previously. The highest figures for Swedish Lloyd ships so far achieved are:

For discharging: 40 tons per gang-hour
For loading: 47 tons per gang-hour.

Quicker Turnround

Cargo ships earn no revenue while they are tied up to their berths. All they do is add to already high distribution costs. For each day in port, a modern cargo liner loses £200 a day in unearned depreciation alone. Shipowners should well remember Britain now owns only 18 per cent of the world's tonnage—compared with 41 per cent in 1939. Every ship now running must do more work. On average, ocean-going ships spend only 45 per cent of their lives at sea: short-sea traders are sailing under 40 per cent of their time. Ships thus spend longer in loading and discharging cargo than in carrying it. (Small fleet owners can compete successfully with bigger lines if port times for their ships are cut, allowing their vessels to carry greater tonnage annually.)

Increased mechanization for the loading and discharge of Swedish Lloyd ships, trading from the Tyne to Scandinavia, now allows one vessel to do the work of two. Palletization and trucking has reduced the time for Swedish Lloyd vessels at Gothenburg from five days to one. Discharging and loading in this country has been reduced from 1½ days to five *hours*. These savings mean that a round trip (Gothenburg-Leith-Newcastle) takes a week—as opposed to a fortnight before.

Turnround times for ships of the Bergen Line have been halved, with 22-knot vessels now making two round trips a week. Before the advent of mechanization, one round trip took five days. Quicker handling with modern materials handling equipment has permitted both the Swedish Lloyd and Bergen Lines to carry the same amount of cargo annually with one ship instead of two.

Recently, a case was cited where the use of industrial trucks, both on the quay and aboard ship, cut turnround time from 48 hours to less than 12. An American coastal shipping firm was saved from the brink of bankruptcy by the introduction of 'Worksaver' trucks on board ship and in warehouse, permitting the loading and discharge of up to 60 tons/hr, and the completion of daily runs around its course, as opposed to a three-times-a-week cycle.

Less Damage and Lower Handling Costs

Mechanization can reduce damage and cheapen handling costs for port authorities and stevedoring concerns. The following excerpt is taken from a statement by an Asian port executive who recommended the purchase of materials handling equipment to modernize facilities for greater efficiency:

> 'The use of trucks will enable . . . packages to be easily transported from quayside to transit sheds. This will not only expedite discharge of cargoes but will also result in a fall in the number of claims received for wet damage and increase the storage capacity of our transit sheds'.

One shipping firm's claims adjuster reported that fork truck handling of unit loads had reduced the number of claims for cargo damage by 75 per cent. A well-known Dutch shipping firm effected a remarkable reduction in handling costs by the use of modern handling methods. During an eight-hour shift one fork truck could handle an average of 80 tons. Formerly, this would have required 16 men. Analysis showed that, during a shift, handling costs were cut by approximately 6s. 8d. per ton.

Ship and Harbour Design

Mechanization must attract port authorities—by it a port attracts more trade through speedier, safe handling and quicker turnround. Mechanization can bring this speed up but it must be integrated with shore facilities, which should be improved. Quayside trucking necessitates good, smooth wharf aprons, countersunk rail lines and better storage facilities.

What of mechanized handling in the ship itself? All manner of shore practices await greater exploitation on ships—belt conveyors, cargo lifts and industrial trucks could be used in vessels. Working surfaces usually deter fork truck operation aboard ship unless the decks are flushed and hatch coamings have been done away with. Trucks are naturally not so mobile in a ship's hold, but can be used in favourable conditions. Such equipment as powered or hand-operated pallet loaders can play an extremely useful part, particularly in the wings and ends of a ship's hold, transporting slings of cargo to and from the square of the hatch.

When it is considered what resources are marshalled by shipbuilders and marine engineers to reduce by the merest fraction the operating costs of a ship at sea, it is amazing how little concerted effort is put into reducing time in port.

All in all, the mechanization of British ports is an issue which is being discussed by many parties with various points of view. Co-ordination of those views will help to introduce increased mechanization in Britain's ports, bringing general benefits to ships, labour and trade. This must be done now if unemployment, strikes and pitched battles are to be avoided in the port revolution which will surely come.

Where conditions are favourable, trucks like this Yale 'Worksaver' can reduce both loading time and damage to cargo

HANDLING IN THE FACTORY OF THE FUTURE—PART 2

In this second part of a review of developments in the production and use of computers and ancillary equipment, new devices are described for handling input and output data at speeds approaching or equalling those of the digital computers themselves

This new tape-deck is designed to meet the needs of the data processing engineer. Four of the speeds provided, within a range of 0·5 in/sec to 120 in/sec, can be selected instantaneously and up to 24 channels are available on the 1-in tape (E.M.I. Electronics, Ltd.)

Until recently, a full realization of the potentialities of high-speed data processing systems has been handicapped by the lack of equipment capable of dealing with the information passing to and from the computer at anything approaching an adequate speed.

At the first Electronic Computer Exhibition to be held in Great Britain there was evidence that much has been done to redress the lack of balance. Improved means were shown for handling and feeding magnetic tape; for reading figures, printed characters, and codes punched in cards and paper tape; and, on the output side, for printing out or coding the computed information.

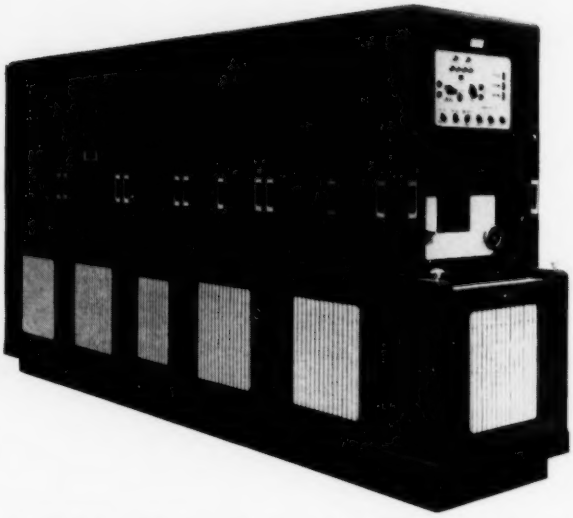
Some of these achievements represent a break through, and the most important of them will now be described briefly.

E.M.I. Tape Deck. In their new EMIDEC 2400 digital computer, with an operating speed-range of 25-40 microsec for the setting-up and executing of an instruction, E.M.I. Electronics, Ltd. have a high-speed diode-capacitor store of 64 words, with magnetic-core peripheral storage, 4-in magnetic tape for bulk storage, and 1-in magnetic tape for integration. The tape is 2,400 ft long, with a storage density of 100 bits/in. It moves in both directions at a speed of 200 in/sec, thus presenting information to the reading device at the rate of 20,000 characters/sec. It can be started or stopped in less than 5 millisec, and reversed from full speed forward to full speed back in less than 7 millisec.

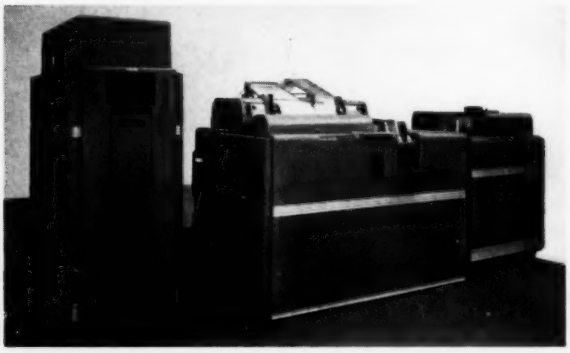
In the 'Emidec' 1-in digital tape-deck, E.M.I. Electronics, Ltd. have succeeded in combining a very high bi-directional tape-speed of 200 in/sec with start and stop times of less than 5 millisec. Out-of-contact operation of the multitrack heads ensures long tape life

The magnetic tape, which is oxide-coated, must be carefully handled to avoid damaging the surface. It is driven by a dual vacuum-capstan device disposed about the magnetic heads mounted on the tape bridge and rotating continuously. Buffer storage between tape-spools and capstans is afforded by two tape-bins. The tape in each bin is maintained at a predetermined level by an electrical sensing device actuating the servo-controlled main tape spools and vacuum binning capstans. This arrangement ensures that correct tension is maintained in the tape as it is wound on and off the spools.

This equipment provides an input and output medium that is realistically related to the performance of the Emidec computer. Standard Telephones & Cables, Ltd. showed a tape-deck and loop-storage bin designed to provide a high-speed, large-capacity binary store that could be used in conjunction with the 'Stantec Zebra' computer. The tape is driven, in one direction only, at a speed of 100 in/sec by a single constantly rotating capstan, against which it is held by a partial vacuum on one side and pressurized air on the other. When the tape is stopped it is held away from the capstan, which continues to rotate, by reversing the air-pressures.



Powers PCC digital computer, controlled by punch-card programmes, feeds, processes, and punches up to 7,200 cards/hr



Demonstration set-up for a stock-control application performed by IBM linked 421 and 604 calculators, and printing and card-punching equipment

BELOW
This loop-store tape machine on the Standard Telephones stand, with a sensing speed of 5,000 characters/sec, was linked to the Rank Xeronic printer

Short's general-purpose analogue computer, simulating in both real and condensed time, is an ideal instrument for the design of servo systems

ERA Reader.—An alternative to the card and tape readers on the input side is afforded by Solartron's Electronic Reading Automation (ERA), which can read numerals and selected letters in any type-face, printed on roll, straight into the computer, with an accuracy of 1 in 1 million. The roll is carried smoothly on a vacuum belt under a cathode-ray scanner and the printed letters and figures are brought under the scanning head at a speed of 200-300 characters/sec.

High-speed Figure-reader. E.M.I.'s FRED (Figure Reading Electronic Device) was one of the unfinished prototypes. With a reading speed of 10,000 characters/sec, he obviously could not have been allowed to miss the exhibition. Precise information on FRED's make-up is not yet available, but we understand that the device can operate either optically or magnetically. The type-face must be of prescribed design, as illustrated in our reproduction of specimens printed on paper tape, but is well within normal printing-press tolerances. For magnetic reading, special ink must be used.

Both Solartron and E.M.I. have found that the maximum speed of their devices is governed in general by mechanical limitations. Solartron are developing methods of reading handwriting and of reading from discrete documents, and say that these developments have depended on the availability of equipment for feeding material at 'reasonably' high speed. Given that requirement, they state that ERA could read tally-rolls, microfilm, cheques and invoices, typed documents, and typed or punched cards.

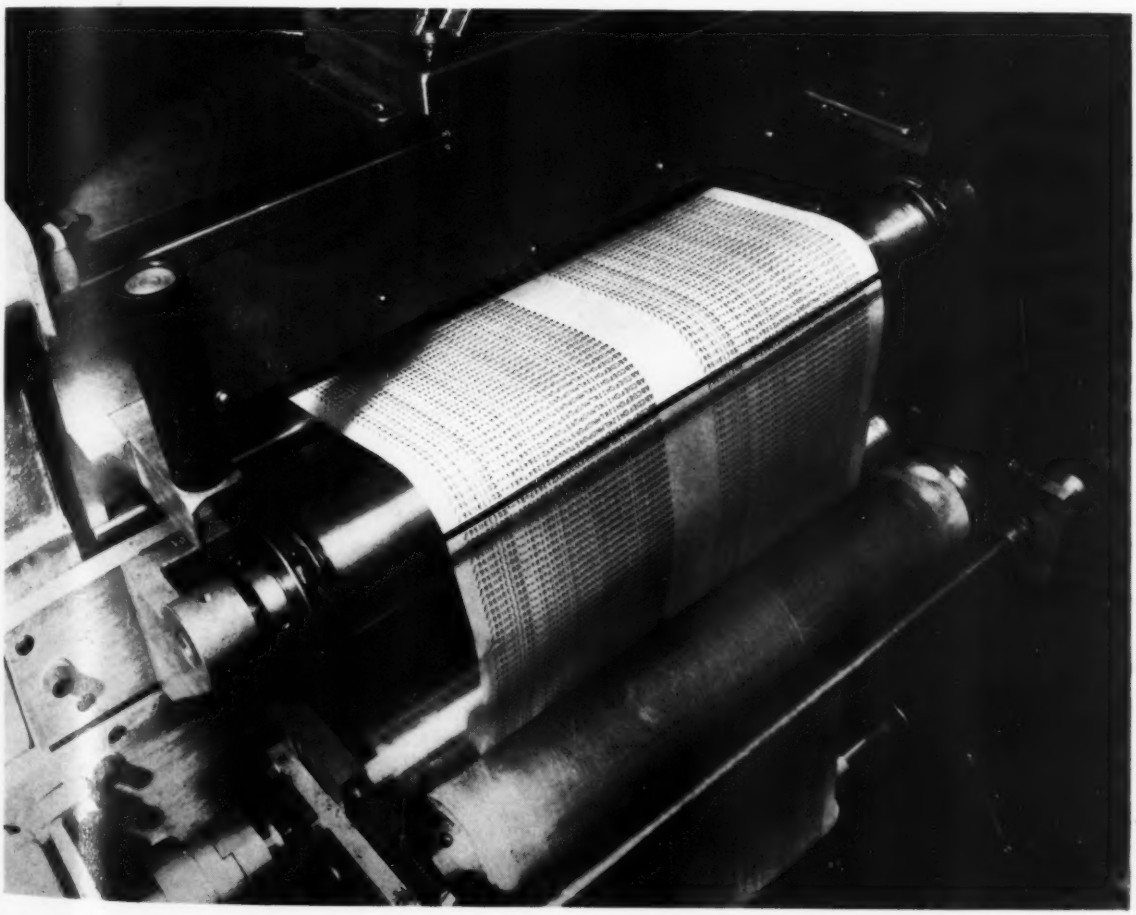
Elliott Tape-reader. Phototransistors are employed as sensing elements in the 5-8-hole paper-tape reader introduced by Elliott Bros. (London), Ltd. The instrument can operate at reading speeds up to 1,000 characters/sec and be stopped within a character. The tape is drawn through the reader between a driving and an idling roller. The lower idling member is controlled by an electromagnet, which can be used to disengage the tape from the drive-wheel. A second electromagnet controls the pressure on two flat surfaces between which the tape is passed and over-rides the action of the driving rollers when braking pressure is applied.

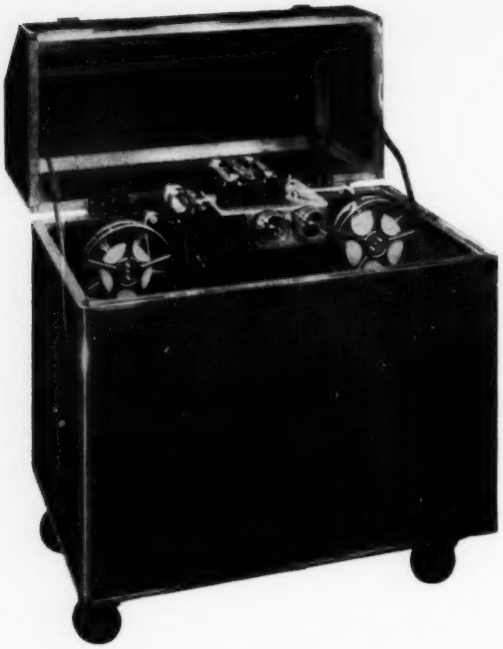
When appraising the value of auxiliaries such as this tape-reader (and the Standard Telephones magnetic-tape loop-storage and ERA reader mentioned previously), it is necessary to note their affiliations. Though each of these equipments is meritorious in its own right as an ably conceived and soundly executed device, it should in fairness be associated with the type of application for which it is peculiarly appropriate. Thus the affinities of Solartron are with aircraft, cybernetics, control engineering, and SPACE analogue computers; hence ERA was probably conceived in terms of variety of input data rather than the mass uniformity of coded cards and tapes that are the raw material of data processing systems. And the particular and specific usefulness of the Elliott tape reader may well be found in association with the shared-time control-loops of a National-Elliott 802, as a means of feeding in a special programme of instructions for immediate processing. That these equipments happened to have filled wider needs, because they were the farthest advanced in their field, may be coincidental.

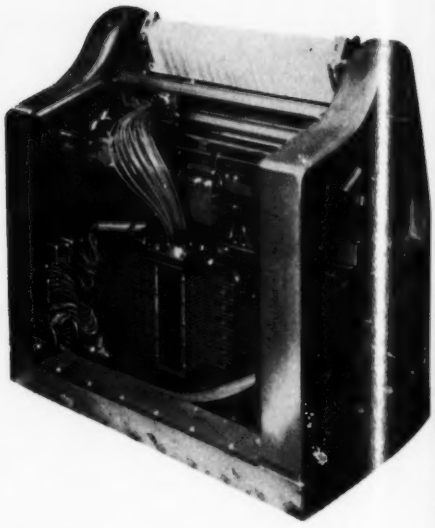
Elliott's new machine can read punched paper tape at a speed of 1,000 characters/sec and can stop within a character

ABOVE
Figures in the type designed for FRED, E.M.I.'s electronic device for reading printed figures at the rate of 10,000/sec

BELOW
Prototype of Rank Xeronic computer-output printer, operating at 1,500 lines/min on a 128-character line. The production model will print out at twice this speed, and print its own forms







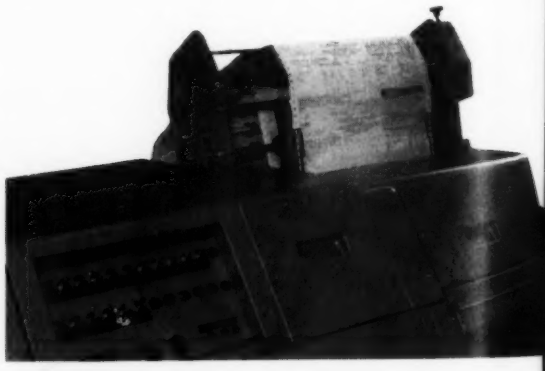
ABOVE
Experimental prototype model of Creed 1000 *output printer,* 15 *times as fast as other machines in its class*

LEFT
With an operating speed of 3,000 *words/min, this Creed* 3000 *tape-punch, (shown with cover opened) is ten times faster than its predecessors*

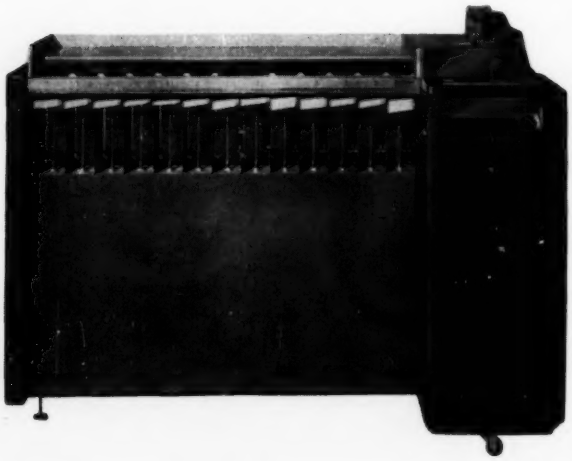
80-*Column Card-punch.* Volumetric capacity of the punched card has been greatly extended by the introduction by Powers-Samas of the 80-column card. With inter-stage punching it provides 1,920 punch positions: a unit capacity that goes some way toward redeeming the comparatively slow operating speed of which a card-punch is capable.

Creed Tape-punch. With an output of 300 characters/sec, the new tape-punch developed by Creed & Co., Ltd., is about 10 times faster than other punches in general use and probably attains the peak speed that can be reached by a combined electromagnetic mechanical system.

The Creed tape-printer, employing electronic and hydraulic principles in conjunction with the traditional electromagnetic and mechanical techniques, is 15 times faster than the normal teleprinter with which the name of Creed is associated. It is intended for use as a direct output recorder or as auxiliary print-out equipment for the punch.



Fanfold UPF 'Carabline' feed, for Hollerith 902, *by which five parts can be fed in perfect register*



Punched cards can be sorted by this electronic machine into 13 *different pockets at the rate of* 1,000 *cards a minute (IBM United Kingdom, Ltd.)*

'*Samastronic*' *Printer.* To reach a speed nearer to that required of a printer fed directly from the computer or by magnetic tape, Powers-Samas went right away from traditional methods and employed electromagnetically operated styli to scan the printing surface. Spacing is 10 characters/in and height of character is determined by the speed at which the paper is fed.

Xeronic Printer. From the bewildering variations in speed of the input and output equipment under review, and the depressive effects of zero correlation among the parts of what should be a continuous in-line sequence, one is brought with an exhilarating bang into the true line of the high-speed digital computer by the Xeronic printer, a machine that operates at around computer speed.

As exhibited in prototype form, it was printing on 11½-in line of up to 128 characters, at the rate of 1,500 lines/min. It was linked to the magnetic-tape loop-storage on the Standard Telephones stand that has already been described. In production models the printing rate will be doubled by

the incorporation of a xerographic copying machine capable of a speed of 3,000 lines/min. It will handle paper of twice the width, and print two lines of 11½ in width containing 128 characters, or four lines of half that width and capacity.

Interdependence All Along the Line

It is in this scale—5,000 lines/min, 256 characters/line, 21,000 characters/sec—that we should think of computer feeds and outputs; for the machines themselves, the digital computers must become faster before the optimum is reached. It may be that there will be less material at the intermediate stages, less coding and decoding of cards and tape. The problem of the inability of mechanisms to keep pace with the movement of material to and from the computer may be solved by keeping it longer in the form of electrical energy, or by enabling much of it to be eliminated by instructing the computer to select and work on variances and discard normal signals. But, until the completely self-regulating factory is achieved, there must come the time when the electrical pulse is translated into marks on paperwork.

Document handling and storage may be expected to become increasingly mechanized, and there seems no reason why filed information should not be held in live storage under automatic control. As we come under the influence of the precision and logic of the computer's routines we shall grow less tolerant of our habitual clumsy methods and wasted effort and lean more toward integration and interlocked controls.

Dynamic Uses of Computers

It seems but a short step from the accounting function of the computer to the direct use of computer-derived information to initiate signals leading to direct physical control. To take a simple example, suppose a computer were installed in a processing factory, it could be made to receive signals when a certain variable component of a raw material reached a critical value—say, the water content of flour for biscuit-making. Suppose, further, that this could be rectified by longer baking time. The computer could be programmed to determine the extra baking time needed and the correction that must be made to the speed of the oven conveyor. It could then go on to calculate what compensating adjustments should be made at other stages in the process and initiate appropriate signals.

Control loops could be set up to provide a feed-back system for testing the effects of variables such as speed, gradient, loading, acceleration and deceleration, upon the running costs of a conveyor or the segregation or damage of the payload. The effects of different control settings could be recorded and analysed. Conditions could be established at various datum points. Data could be established for the integration of two or more systems. A computer with control loops could become an effective instrument of continuous operational research.

Panellit showed a system equipped with no fewer than 600 take-off points for the continuous analysis of temperature rises in a reactor; their associates on the National-Elliott stand demonstrated a technique by which computer time could be shared for such purposes as control investigations. Such uses of computers offer immense possibilities, especially in the handling field, and may well be the means of a new and more exact approach to the dynamics of materials movement.

NOMOGRAM SIMPLIFIES SPECIFICATION OF CONVEYOR-BELT WIDTH

The accompanying nomogram, prepared by the Sandvik Steel Band Conveyor Co., Ltd., of Selly Oak, Birmingham, provides an easy way to determine the proper conveyor-belt width for handling bulk materials.

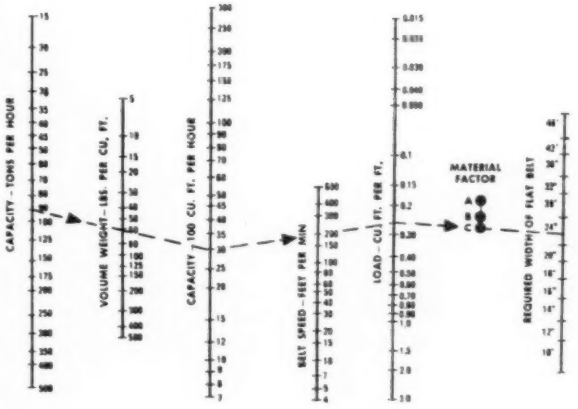
To use the nomogram, it is necessary only to know the tonnage of material to be moved per hour, its density in lb/cu. ft., conveyor speed (ft/min), and a 'material factor', 'A', 'B', or 'C', which depends on the characteristics of the material being handled. This factor may be determined from the following table:—

		Factor
Materials with sharp edges	*With or without dry fines*	**B**
	With moist fines	**C**
Materials with round edges	*With or without dry fines*	**A**
	With moist fines	**C**
Powdered Materials	*Dry*	**A**
	Moist	**C**
Plastic Materials		**C**

Materials with sharp edges include ores, quartz, limestone, clinter, coal, coke etc. Materials with round edges include items such as cement, clinker, granulated products, gravel, seeds, potatoes, beans, grain, etc. Powdered materials generally are obtained by grinding and include ore concentrates, foundry sand, cement, etc. Plastic materials include dough, fats, clays, margarine, paper pulp, mash, etc.

Although Sandvik developed the nomogram for use in specifying steel belt conveyors, it may also be used for other types of flat-belt conveyors.

*The tons in the nomogram are short tons, i.e. 2,000 lbs.


CAPACITY - TONS PER HOUR
VOLUME WEIGHT - LBS. PER CU. FT.
CAPACITY - 100 CU. FT. PER HOUR
BELT SPEED - FEET PER MIN
LOAD - CU. FT. PER FT.
MATERIAL FACTOR
A
B
C
REQUIRED WIDTH OF FLAT BELT

As indicated by the example illustrated on the nomogram, to find the belt width recommended to carry 90 tons/hr* of a material weighing 60 lb/cu. ft. at a speed of 200 ft/min and having a material factor of 'C', one would locate 90 on the 'tons per hour' scale and project a line through 60 on the adjacent 'lbs per cu. ft.' scale until it intercepts the 'cu. ft. per hour' scale. A line is then drawn from this point through 200 on the 'feet per minute' scale and extended to the 'cu. ft. per ft' scale. From here the line is extended through the 'material factor' designation 'C' and the intereception of this line with the final 'width' scale indicates that a 24-in belt should be specified.

Report of an investigation into the facilities afforded to users of Caterpillar tractors by the service and parts department of Leverton of Leeds

SERVICE FOR TRACTORS

By K. MUMBY

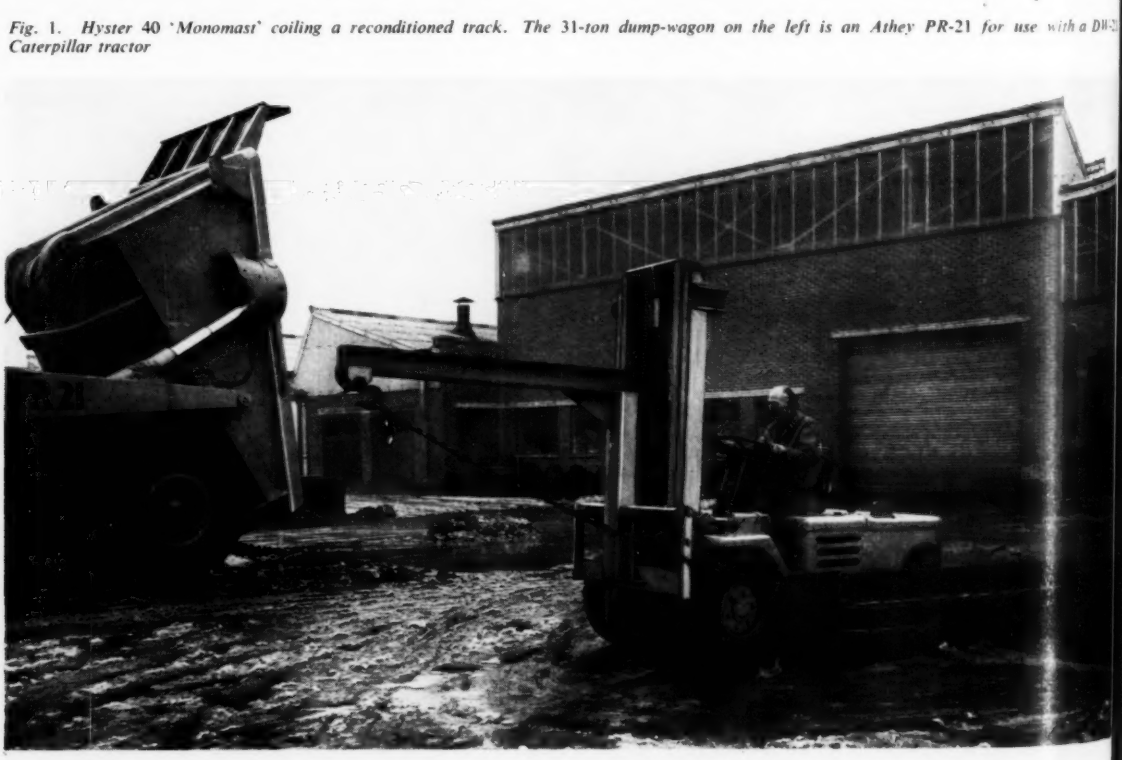
FOLLOWING our report in a previous issue of *Mechanical Handling* (March, 1958, pages 138-143) on the parts and service functions of the Fred Myers organization, we have been invited to examine the facilities provided by Leverton of Leeds, Ltd., who have recently opened a new depot and showroom in Gildersome. Both companies are Caterpillar and Hyster dealers, but whereas our previous investigation was directed mainly toward the servicing and repair of fork lift trucks, the emphasis in this report is upon the tractor side—since the Leeds member of the Leverton group is specializing almost exclusively on Caterpillar work. In this depot, as at Windsor and Brentwood, we were afforded every facility to make a thorough investigation, and the two reports may be regarded as covering the complementary aspects of the activities of Hyster and Caterpillar dealers.

Leverton were founded more than 50 years ago by Fred Myers, the late husband of the present chairman, Mrs. D. M. Myers, and father of the present managing director. A quarter of a century later, when the Caterpillar Tractor Co., of Peoria, Illinois, started exporting their earthmoving equipment, Leverton were appointed their agents. They are now the oldest Caterpillar equipment dealers in Great Britain. When the first consignments reached Britain in the mid-1930's, a Cat was powered by a 40-b.h.p. engine and could move 4 cu. yd. of earth in its scraper and travel at a speed of about 4 m.p.h.

These incidents in the company's history were recounted at the opening of the Gildersome depot, which is equipped to cater for machines capable of moving 25 tons of material at speeds of up to 25 m.p.h. From 1950, when Fred Myers, Ltd., were formed as an associated company to deal with London and the south, expansion was rapid. Leverton depots were established in Spalding, Leeds, Wigan and Gateshead. Caterpillar Tractor Co. also expanded their establishment in this country and a factory was obtained in Newcastle for the manufacture of Caterpillar equipment, also an entire R.A.F. aerodrome for use as a warehouse at Desford in Leicestershire, for the distribution of parts. In the autumn of 1958 in their big new factory in Glasgow, on a 65-acre site, Caterpillar Tractor Co., Ltd., went into production of the new D8 crawler-tractor with 225-b.h.p. turbo-charged engine, which exerts a 44,000-lb drawbar pull and is capable of filling and hauling a scraper with a capacity of more than 25 tons. This will be followed by the D4, the 'Traxcavator' range of crawler-mounted excavators, and eventually by virtually the entire range of Caterpillar tractors and equipment and Caterpillar engines.

Four new autonomous companies have been formed to

Fig. 1. Hyster 40 'Monomast' coiling a reconditioned track. The 31-ton dump-wagon on the left is an Athey PR-21 for use with a DW-21 Caterpillar tractor



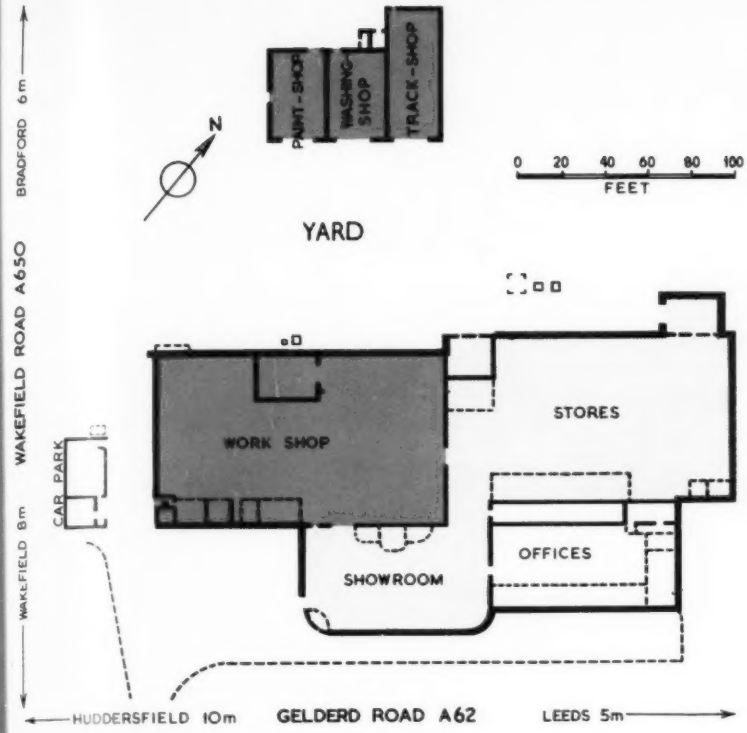


Fig. 2. Layout of the new Leverton depot at Gildersome, Leeds. On a 5-acre site, with an enclosed floor area of 33,120 sq. ft., it provides comprehensive service and spares facilities for Caterpillar users

take over the work of the depots at Spalding, Wigan, Leeds, and Gateshead. With the other Caterpillar and Hyster dealers shown on our chart in Fig. 10, they handle the products of factories in Great Britain, America, Holland, Australia, and Brazil, and provide a network of co-ordinated service and parts facilities for customers throughout Great Britain and Ireland. Since all the dealers follow the same standard procedures and share the facilities for training and education available to all members of the Caterpillar organization—through the media of visits, films, lectures, and printed material—the conditions obtaining at Leverton of Leeds may be taken as broadly representative of the general practice.

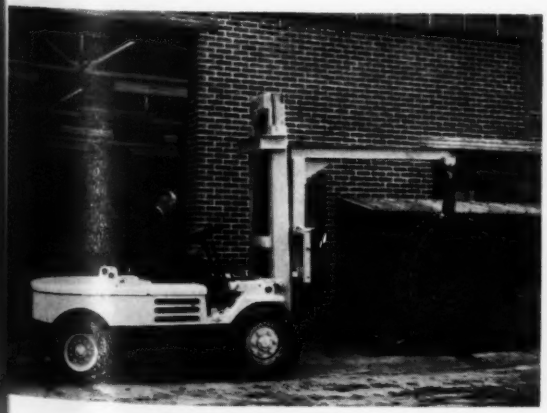
Within the Leverton group all dealer firms have the organization structure indicated diagrammatically in Fig. 13, in which the service, parts, sales and accounts functions are administered by departmental managers. This review is concerned only with the service and parts departments, which are on call throughout the 24 hours every day of the year. By this, we mean that the administrative head of the department is permanently on call, and that customers are given a card bearing the name and home telephone numbers of the men in charge of service, parts and sales, in addition to the telephone and Telex numbers of the depots. This card typifies the attitude of Caterpillar and Hyster dealers towards their work and their customers.

Gildersome Depot

Fig. 2 shows the layout of the depot at which this investigation was conducted. It is built on a five-acre site five miles outside Leeds at the junction of the main road to the north-east and south-west through Leeds and Huddersfield, and the A650 to Wakefield and Bradford. A total area of 33,120 sq. ft. is enclosed by a large and small block of buildings separated by a yard. In the main block, a section of 10,729 sq. ft. is occupied by the workshop, and another large share of the floorspace—10,644 sq. ft.—is allocated to

Fig. 3 (below). 'Monomast' handling coiled track in yard outside repair shop

Fig. 4 (right). General view of store



storage of parts. Across the yard, the whole of the smaller block of 3,464 sq. ft., housing the air-conditioned paint-spray, the wash, and the track shop, is devoted to service facilities. Showroom, with parts counter, offices, and an excellent canteen, are accommodated in the remaining parts of the main block. Exterior and interior views of the depot can be seen in Figs. 1, 4, 8 and 9.

Facilities for Servicing, Repairs and Reconditioning

At all the Leverton depots, the service function is exercised through two departments—one undertaking all services carried on inside the premises and administered by a works manager, and the other maintained exclusively for outside work and staffed by a team of field engineers and fitters under a field service supervisor.

The service department is responsible for providing the customer with the means of maintaining his equipment in good trim and executing routine and emergency repairs, and also for providing a reconditioning service for worn parts. These responsibilities involve not only the maintenance of adequate workshop plant and equipment and a staff of expert engineers and fitters with specialized training, but also the keeping of accurate and comprehensive records of all data appertaining to the performance of Caterpillar machines and their working environment.

Servicing Arrangements

Routine after-sales servicing arrangements cover a warranty, measured by hour-meter recorders, during which service visits are made free of charge to the site. At the end of this period the dealer offers an optional quarterly field inspection. During and after the period covered by guarantee, the customer must be assured of full repair facilities, on or off the field, and he must be able to call upon a mobile team at any time to help him out of a difficulty.

Each customer and each machine has a card on which details are recorded of visits, deliveries, troubles encountered, and other incidents that go to build up a full case-history, and this record card is of great help when an emergency arises. Service reports from the engineers constitute valuable supporting documents, and copies of these reports are sent to the manufacturers for the information of the designers.

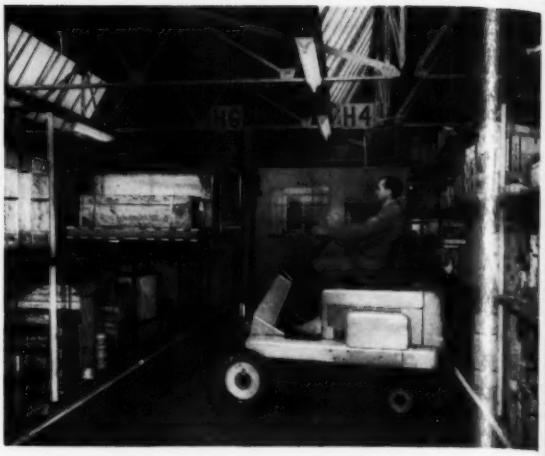


Fig. 5. Throughout the depot material is handled mechanically. Palletized stock is seen on forks of Hyster 80 in this view of spare parts store

Three field engineers are attached to the Gildersome depot. They are supported by a fleet of seven service vans manned by fitters. Caterpillar attach great importance to the specialized training of their fitters and make use of refresher courses, films, and a constant flow of technical literature, to instruct them in new theories and techniques. News of recent developments is circulated via the same media to the other departments and to the customers, all of whom are kept continuously informed on current American and Continental practice as well as on that in their own country.

Vans are equipped with a full complement of fast-moving spares, such as gaskets and small sealing and jointing parts, and with the special tools such as pullers, gauges, and hydraulic presses, that may be needed in an emergency. Thus equipped, and with the information provided by the customer and machine records, the service crews are in a strong position for dealing with any contingencies.

In addition to routine and emergency maintenance and repair, the dealers offer extensive reconditioning facilities

Fig. 6. Section of binning area for small parts

Fig. 7. Double-ended chests of drawers of type seen on left, which will save space and provide protection against dust and moisture, are soon to replace the inclined trays for the storage of gaskets

designed to save much of the expenditure that customers would otherwise incur in replacing worn parts. These include the provision of dynamometer-tested reconditioned engines to replace units brought in for repair or overhaul; the rebuilding of worn track-links, shoes and sprockets; and the reconditioning and testing of fuel pumps and injectors. Old machines are accepted in part exchange for newer models. Sometimes, as a result of the prolonged period during which imports were made impossible by dollar restrictions, very ancient tractors are brought in; recently, for example, a 1923 Cat 60 was accepted in part exchange from a northern docks and harbour board, after more than 35 years' good service.

Test Equipment

Hundreds of special tools are needed to enable repair operations to be undertaken on the full range of Caterpillar models imported into and manufactured in this country—and that, needless, is what Leverton set themselves out to do. Their tool store occupies a floor area of 315 sq. ft.

When a tractor comes in for repair it is subjected to a jet of high-pressure steam, at 150 lb/sq. in. from a Bastian & Allen 'Speedyjet' cleaner which removes all dirt and grease and leaves the surfaces of the metal perfectly clean and dry. The machine is then inspected all over, and wear, damage, misalignment, or fractures are revealed.

Every engine is tested before leaving the depot on a Heenan & Froude dynamometer, which is capable of measuring power outputs between 50 b.h.p. and 1,000 b.h.p. to a high degree of accuracy. The energy transmitted by the engine under test is converted entirely into heat, which is transferred to cooling water circulating in the annular gap between the rotor and stator and passed continuously through a cooling tower installed in the yard, in the open air. The torque capacity of the Heenan & Froude dynamometer is high at low speeds; a characteristic that is especially useful when testing the power available at the tracks and has been exploited at government testing stations for the examination of tank tracks. Fig. 11 shows an engine on the test bed.

Reconditioned fuel pumps and injectors are tested in a dust-proof room and calibrated with the aid of a panel built by Leverton of Spalding.

Track Reconditioning

Idlers and track rollers are reconditioned by building up the worn surfaces by welding and restored to their standard diametric dimensions. Typical operations can be seen in progress in Figs. 8 and 14; Fig. 15 shows how a worn sprocket is restored by welding a new rim on to the old hub.

Fig. 8. Track rollers and sprockets are reconditioned in this part of the workshop

Fig. 9. Part of the tractor repair shop

In a section of the smaller block across the yard that houses the paint-spray and 'Speedyjet' cleaner, the tracks themselves are rebuilt by submerged-arc welding and restored to 80 per cent of their original strength at a fraction of the cost of replacement by new parts. Shoes are rebuilt by welding a preformed bar on to the worn shoe, and links are continuously welded by the process shown in Fig. 16. The track is laid out on a table, alongside a conveyor carrying the welding head, which travels with an intermittent motion controlled by cam-actuated microswitches. The conveyor is stopped automatically when it reaches each predetermined station along the track and the welding cycle is initiated by a relay.

'Lincolnweld' and 'Unionmelt' processes are employed for the submerged-arc technique, in which the parts to be welded are covered with a blanket of granular flux. The bare metallic welding electrode is fed into the blanket at a controlled speed. When the electric arc is produced and fusion occurs, the flux floats to the surface of the molten metal, leaving a clean weld protected against oxidation. There is complete freedom from spatter and spark glare, and a high amperage can be used to increase welding speed and lower cost. The fluxes used are grade 80 'Unionmelt' and Lincoln 'Shield Arc', both of which are wear-hardening.

Worn track-pins and bushes are replaced by new standard pins and new bushes, the parts being withdrawn and inserted hydraulically. As we go to press the existing single-ram unit is being replaced by a Rodgers Twin Ram 150-ton hydraulic press. With this equipment, a link, with two pins and grouser attached, can be extracted, taken apart, and reassembled in a few seconds.

Lengths of track are pulled on to the conveyor by a winch developing 5,000 lb pull, and thereafter moved in either direction by an 8-ft reversible powered section of the rollers, extended at both sides of the press by 8-ft gravity sections.

After the new press has been installed, all welding equipment will be brought into the track shop. At the high speeds

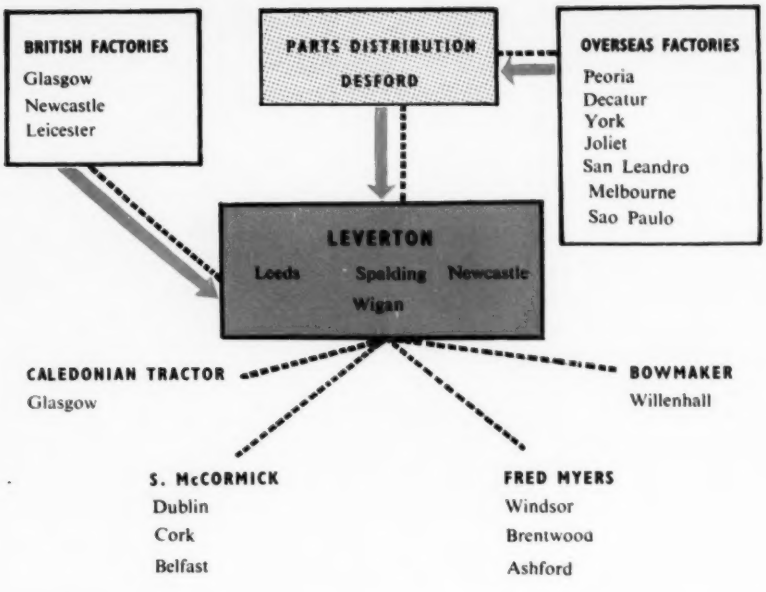


Fig. 10. Diagram showing lines of communication between Caterpillar factories and dealers. Leverton depots are linked by Telex with all U.K. depots and factories and with Desford distribution centre for American spares

with which welding and assembly will then be effected, it is anticipated that the time schedule for track reconditioning will be considerably reduced.

Parts

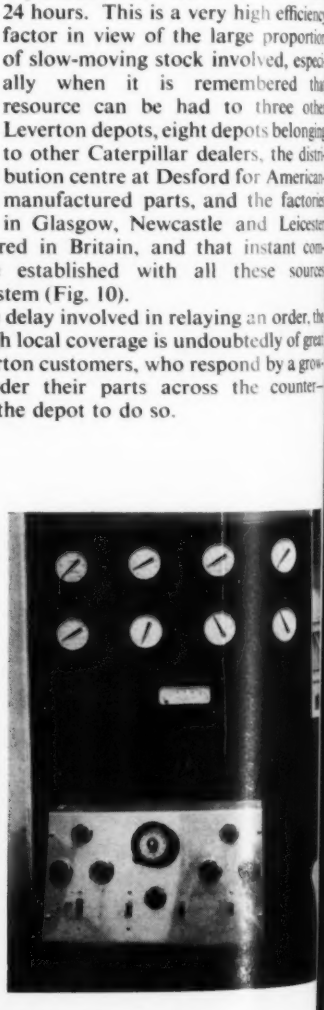
Reconditioning is undertaken for the sole purpose of saving the customer's money, but the gain would become a loss if parts had to be modified or improvised for lack of adequate replacements. Such an eventuality is made almost impossible by the system of inventory control evolved by Caterpillar and followed in the standardized techniques employed by all the dealers and in all the factories and distributing centres.

Replacement parts are held to a minimum stock level for all machines in service in Great Britain, even though the current age group includes models between three years and 20 years old. This means that 12,000-13,000 different items must be held in store. Of these only 4,000-5,000 are classifiable as fast-moving, for many of the components of the older machines are not interchangeable with those of the new models. It was noticeable at the Gildersome depot that not a cubic foot was wasted of the space available in the 8,962-sq. ft. storage area.

During the last five months, 91·8 per cent of the orders received by the parts department were met ex stock within 24 hours. This is a very high efficiency factor in view of the large proportion of slow-moving stock involved, especially when it is remembered that resource can be had to three other Leverton depots, eight depots belonging to other Caterpillar dealers, the distribution centre at Desford for American-manufactured parts, and the factories in Glasgow, Newcastle and Leicester for parts manufactured in Britain, and that instant communication can be established with all these sources through the Telex system (Fig. 10).

However short the delay involved in relaying an order, the maintenance of a high local coverage is undoubtedly of great convenience to Leverton customers, who respond by a growing tendency to order their parts across the counter—sometimes flying to the depot to do so.

Fig. 11. Engine of D6 Caterpillar tractor on test-bed of Heenan & Froude dynamometer. All reconditioned engines are dynamometer-tested before dispatch to customers



ABOVE:
Fig. 12. Cambridge indicator and dynamometer control panel

Fig. 13. Skeleton organization chart of Leverton group of Caterpillar and Hyster dealers

Initial stock for new machines is based on the recommendation of the manufacturer, after which re-ordering is done on the basis of a quarterly analysis of the history of each part. Any part, no matter how slow-moving or how old the machine to which it belongs, is bought and stocked if two or three enquiries have been made for it. On American parts, the lead-time allowances are up to four months on average for the major part of the stock. These allow for a six-week margin over the time needed for normal delivery from U.S.A. Such parts are ordered via Desford but shipped from America direct to the dealer, an arrangement that cuts the cost of double handling and allows the stock in the Desford warehouse to be reserved to meet emergency requirements. Parts needed urgently are handled very quickly indeed; ordering by Telex takes only minutes and parts can be flown over from America in a few hours.

Stock-control Paperwork

Customers' orders—written, verbal, or by telephone—and requisitions from the service department, are transferred to an interpretation form, which specifies the stores location and part number, including old and current part numbers if changes have been made. Revision and correction of parts numbers as items are modified or replaced by new designs is a permanent routine task.

The numbers and descriptions of all the components of Caterpillar equipment are recorded in an enormous book, which contains some 150,000 items, and are revised every month to bring them up to date in accordance with advice received from the manufacturers. The numbers cited by customers must be checked for accuracy against the numbers in the book and also against any advice from the factories of changes that may have come in since the last revision was made. Both the old and the new part numbers are stated on the interpretation form and the documents raised from it. Since so much trouble is often caused by such changes, often in firms where much smaller numbers are involved, the Caterpillar method, which operates satisfactorily, is evidently worth studying.

Nine documents, designed to provide a master record and to inform the customer, storekeeper, and accounts department, are raised simultaneously on an Orlid duplicator from the data recorded on the interpretation form. The master form supplies data for the raising of the basic control documents: the stock order cards which are grouped under box

Fig. 14 (above). Building up a worn roller to save a customer the expense of buying new part

Fig. 15. New rim being welded on to original hub of Cat tractor sprocket

Fig. 16. *Worn track-links restored to original size by continuous and automatic process of submerged-arc welding have* 80 *per cent strength of new linkage*

Fig. 17. *Customer at trade counter of Leeds depot represents a growing number of customers who apply personally for spares, in conviction that they will be supplied direct from stock*

Fig. 18 (*below*). *With everything to hand—current parts-books on revolving stand and Telex link with factories in Britain, Desford distribution centre for American parts, and Caterpillar and Hyster dealers throughout this country and Ireland, telephone enquiries can be dealt with immediately*

numbers and exercise a continuous check of the physical stock and the history card raised for each part, which records the movement of incoming and outgoing stock during each quarter and provides the data needed for the annual reassessment of minimum levels.

Any item ordered that cannot be supplied from stock is entered on a form known as the *back order analysis*, which is drawn up every day and subjected to a post mortem. On it are entered particulars of the actual and minimum stock levels, withdrawals over the past year, dates at which minimum level was reached and orders were issued, and the reason or reasons why an emergency requisition (that is, an order upon Desford or another dealer) had to be made.

Order Chasing

Parts that cannot be supplied from depot stock—the back order items—are chased by Telex, which can be used to reach all dealers, the British factories, and the Desford warehouse. Fig. 18 gives some indication of the speed and convenience with which this can be done. The clerk receiving a telephone enquiry can select the volume he wants from among the current parts books on a revolving stand of Caterpillar design. The clerk at an adjacent table can relay the enquiry by Telex and receive an immediate reply. Customers' orders are filed continuously in another part of the office, while all the necessary forms are produced by the Orlid duplicator seen in Fig. 19.

Storing 13,000 *Different Items*

The continuous check provided by the box-number system of identification, and the way in which it integrates physical stock with paperwork, make it well-nigh impossible for any parts to be wrongly located or overlooked. In spite of the great diversity in bulk and weight of the items dealt with, the storage area, as seen in Figs. 4 to 7, presents an extremely orderly appearance and the space is fully utilized. Outside the binning area, everything is handled mechanically by a Hyster 80 fork truck, Hyster 40 'Monomast', or Herbert Morris overhead crane. Fig. 1 shows how the 'Monomast'

Fig. 19. *Nine control documents are raised simultaneously on this Orlid duplicator*

is used to coil a length of track.

Small parts are stored in Sankey Sheldon and Rubery Owen shelving; larger items are palletized and stacked on tubular racking. Gaskets, which have been displayed on inclined racks, will, in future, all be protected from dust and damp in double-ended wooden chests of drawers of the type seen in the left foreground in Fig. 7. This is another Caterpillar idea, and it will effect a considerable saving in space.

Sharing Experience

There can be no doubt that dealers and manufacturers alike benefit enormously from the pooling of knowledge and experience that has been encouraged by the parent company. The evidence presents itself at every turn—in the workshops, the stores, and the offices—of a constant interchange of ideas between manufacturer and dealer. Though from this article it might appear that the flow is predominantly in one direction, provision has been made for parallel lines of communication in the opposite direction. From the receiving end one would be able to see, for example, the use that is being made by Caterpillar designers of the reports they receive from the Leverton field service engineers, and from their opposite numbers in other parts of the world. And, from time to time, a design modification reveals that information has been flowing freely and effectively along the line that links the users of a machine with its makers.

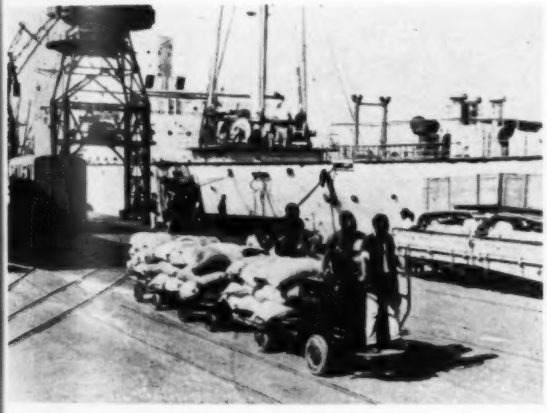
CARGO HANDLING AT BRITISH EAST AFRICAN PORTS

Large fleet of industrial trucks speed shore-handling operations

THE BRITISH EAST AFRICAN PORTS, consisting of the ports of Mombasa, Tanga, Dar es Salaam, Mtwara and Lindi must be among the most highly mechanized ports in the world. The five ports are railway-owned, but all shore-handling operations are carried out by landing contractors, The Landing and Shipping Company of East Africa, Ltd., whose head office is at Mombasa. This company has pursued a progressive policy aimed at ensuring the speediest possible handling of import and export cargoes through the port area.

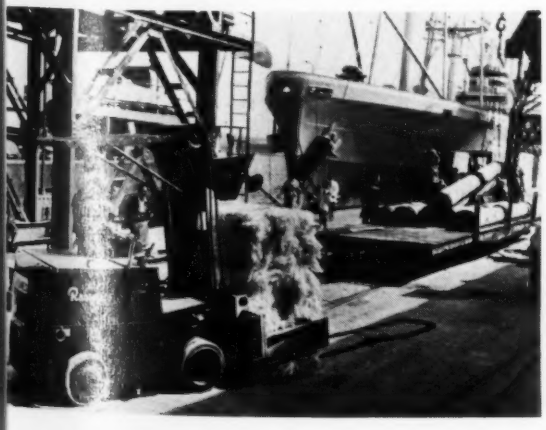
In the early 1950's the company initiated enquiries into the benefits of mechanical handling as opposed to manual handling. For trial purposes, a limited number of petrol, diesel and electric fork lift trucks were purchased. After prolonged experiments, it was finally decided to standardize on Ransomes electric FL40 machines.

Once having embarked upon a mechanization programme, the company has added to its mechanical handling fleet at each stage of development in the respective ports. The total fleet at these ports was recently reported to number 83 fork lift trucks and 91 fixed and elevating platform trucks. A major proportion of these are electric trucks supplied by Ransomes Sims & Jefferies, Ltd., of Ipswich. Some of the machines are seen at work in the accompanying illustrations, reproduced by courtesy of the East African Railways and Harbours Administration.

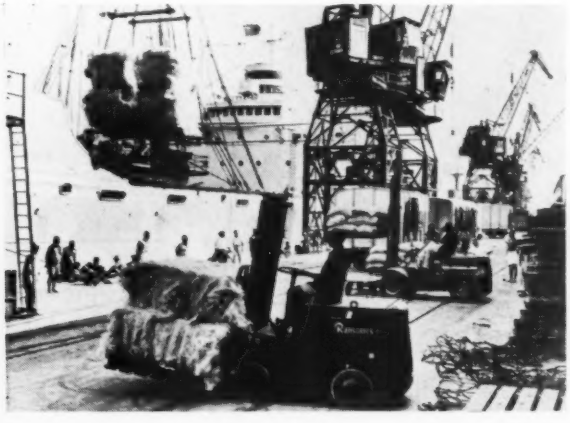


ABOVE
Platform truck with trailer working on an East African dockside

BELOW
Ransomes fork lift truck with load clamp handling baled sisal



Fork lift trucks receiving pallet loads of baled sisal direct from hold of ship



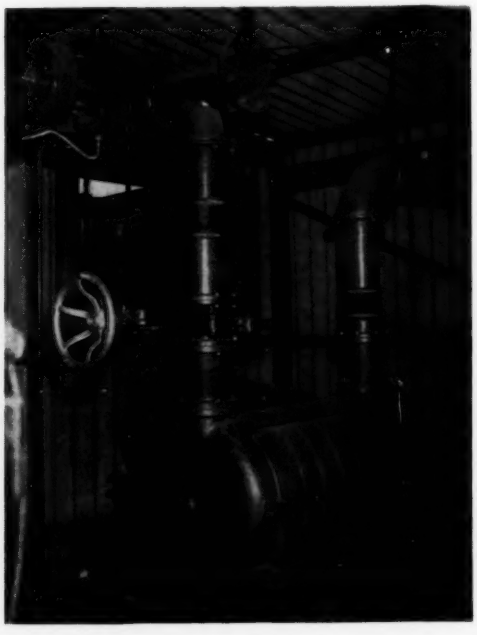
CONVEYING RAW MATERIALS BY VACUUMATION

Pneumatic system aids efficiency at Morgan Crucible Works

ABOVE
The graphite is conveyed in an air stream through the hoses and pipe system to the separator unit mounted in the roof. This photograph shows section of extensive pipework, with separator unit to the right

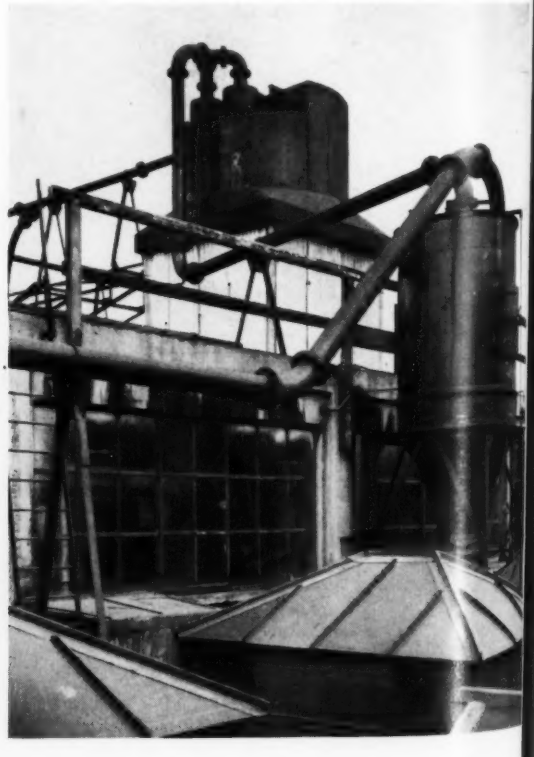
RIGHT
Rooftop view of B.V.C. pneumatic conveying system or graphite at the Battersea works of The Morgan Crucible Co., Ltd. This shows the air exhauster and separator units and some of the pipework

BELOW
The air exhauster unit is driven by a 35-h.p. electric motor geared to give 4,150 r.p.m.



A PNEUMATIC CONVEYING system has been installed for handling one of the most important materials used at the works of The Morgan Crucible Co., Ltd., at Battersea. Movement of graphite was for years a necessarily laborious, dirty and slow undertaking, especially when considered against more progressive aspects of production at this works.

The material arrives by Thames barge, is unloaded at the company's wharf and kept in bulk storage for use as required. Unloading and transfer from the barge to bulk storage is probably a less difficult problem than conveyance from bulk to the production bunkers. Until recently production requirements were drawn off as needed by a familiar operation in which wheelbarrow journeys to and from a bin lift, with consequent dust and waste, to say nothing of hard work in rather unpleasant conditions, were accepted as essential aspects of the job. This process was expensive of space and man-hours, and in terms of time and motion study must have been one of the least efficient of works operations. The whole conveying method has now undergone a revolutionary change, and a new pneumatic conveying system supersedes the entire process of manual operations, from the stage of bulk storage to actual delivery of the graphite at the produce bunkers in the production areas. It can be extended considerably to give, if required,



a virtually automatic flow right from the river to the production points.

The system can be controlled and operated by one man.

The graphite, completely enclosed in its conveying lines, travels in an air stream direct from bulk storage to the required outlets. In place of the wheelbarrows and the bin lift, the material is now conveyed cleanly and swiftly, rising some 75 ft to the roof-top plant, from which it is delivered ready for use in the bunkers below. The system, designed and installed by the British Vacuum Cleaner and Engineering Co., Ltd., is described by them as an important example of vacuum technique applied to conveying of materials. This, incidentally, is a department of pneumatic engineering which is occupying an increasing degree of attention by B.V.C. engineers, and now has a wide variety of applications in British industry and abroad. Vacuumation has proved itself as an economical and trouble-free means of conveying liquids, powders and solids in granular form to meet the requirements of many industries, including foodstuffs, chemicals and heavy engineering.

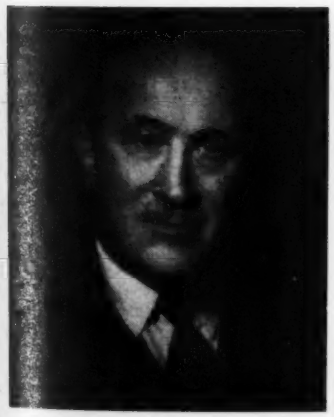
Although extremely simple in principle, the Morgan Crucible installation has a number of notable features. These include level controllers, operating in conjunction with an automatic warning light system to guard against any possibility of over-filling. There is also a spill-out control which shuts off and opens rotary valves to give an automatic regulation of flow of the material in its air stream. The conveying system is complete in itself and designed to handle specific requirements. Its design, however, visualizes the possibility of extensions and provision has been made for addition of a second exhauster which would offer complete interchangeability of units on any of three separate conveying lines. The possibility of a more complete pneumatic transit right from the river up to the production points is thus within the capacity of the system as visualized in the present plan. The vacuumation plant used comprises a motor-driven turbo-type air exhauster, working in conjunction with a separator unit, extensive fixed pipework and flexible hose lines with aerated loading nozzles.

The system of operation is that the material is loaded into the aerated nozzle through a specially designed feed on the existing hoppers. A controlled air bleed on the loading nozzle entrains the graphite, which is then pneumatically conveyed through the hoses and piping to the separator unit mounted on the roof above the produce bunkers. In the separator, the material is extracted from the conveying air by velocity drop, the finer particles being separated through the secondary medium by cyclonic action. By this method the resultant fines are carried through the pipes and finally extracted from the air by a fabric filter fitted in the exhauster unit. The cleansed air is then drawn through the fabric filter sleeves and discharged to the atmosphere through the exhauster outlet.

The system uses a B.V.C. E.8 air exhauster unit, belt-driven by a 35-h.p. electric motor, which is geared to give 4,150 revs/min and handles approximately 800 cu. ft. of free air per min at 9·2 in Hg. The main storage hopper of the separator unit has a capacity of 110 cu. ft. giving approximately 2 tons head of material.

Conveying by vacuumation in this instance gives an efficient control of the flow of material, which is now completely enclosed during conveyance. The system in relation to its capacity is economical in operation and maintenance, saves many man-hours, gives better working conditions, is cleaner and quicker, and shows further economies in the absence of spill and loss by airborne dust.

INTERNATIONAL MATERIALS HANDLING CONFERENCE



Sir Edward Beddington-Behrens, C.M.G., M.C., Ph.D.

PLANS are now in an advanced stage for the International Conference, to be organized by the Institute of Materials Handling, at the Waldorf Hotel, London, in May.

The conference will be opened on Wednesday, May 6th, by Sir Edward Beddington-Behrens, C.M.G., M.C., Ph.D. A large attendance is expected, and several hundred hotel rooms have already been booked for delegates.

The conference theme will be, 'Material Benefits through Materials Handling'. On the first day there will be a number of film shows and a plenary session on 'Economics of Handling in the Common Market'. The second day will be devoted to lectures given in four different groups as follows: (*a*) The Rôle of Containers and Pallets in International Transport; (*b*) Materials Handling and Ships; (*c*) Handling in the Manufacturing Industries; (*d*) Handling in Warehouses.

The last day of the conference, Friday, May 8th, will be devoted to works visits and to a plenary session dealing with 'World Integration of Freight Handling'. In the evening there will be a banquet, which will this year take the place of the Annual Dinner of the Institute.

The following are among the 14 main speakers at the conference: A. A. Harrison (U.K.); J. Dorjee (Holland); P. C. Somerville (U.K.); E. Schneider (Germany); H. Krippendorff (Germany); J. G. Parkes (U.K.); H. Malstrom (Sweden); R. Johnson (U.S.A.).

Anyone wishing to attend the conference should write to H. M. C. Harwood, O.B.E., National Secretary, Institute of Materials Handling, 69 Cannon Street, London, E.C.4.

PACKAGE HANDLING

Dealing with some typical types of equipment for handling a parcel or object with outer covering, cardboard cartons, wooden cases, bottles, cans or tins; also unit articles such as a loaf of bread, stack of newspapers or periodicals, or cardboard cartons in flat form. The article is based on the author's lecture notes. A future article will deal with Package Handling by industrial power trucks.

By J. W. LEECH*

MECHANICAL HANDLING is a service of wide character; it affects everything we eat, wear or use. Besides the mechanical side there is the human relation side, most important in modern management.

Mechanical handling has been within our grasp for centuries, but has only been developed within the last century, through availability of new sources of power, and with ingenuity in applying age-old aids to moving objects.

Objects and Advantages of Mechanized Handling

With the use of mechanized handling we make better use of labour. It enables us to redirect labour from unproductive to productive jobs. It takes unnecessary effort out of labour, and brain-work out of repetition work.

With it we can reduce the time lost caused by accidents.

At a recent lecture given in London by the Chief Engineer of the Government Factory Inspectors, he told his audience that 27 per cent of 50,000 accidents which happened in factories each year were due to normal handling, or rather mishandling. This represents 20,000,000 man-days lost per year which is equivalent to a cost against industry of £70,000,000 per year.

This is a very heavy bill to industry which can be saved by the introduction of mechanical handling devices. It will reduce the damage to goods and cause less fatigue. Mechanical devices are more foolproof and reliable than manual labour.

Smaller raw material stores will save space and, with high stacking, give us the use of roof space.

It will increase the amount of production and decrease the cost of production. By this method we shall obtain greater use of space in manufacture and finished stores.

Consideration of Costs Involved

Cost of capital equipment.
£2,500 to redirect one manual labourer from unproductive to productive job.
Normal equipment should repay capital cost in three years.
Maintenance costs.
Higher with electronic devices compared with mechanical devices.

What is Meant by a Package?

Definitions:
A parcel, or object with outer covering, cardboard carton, wooden case, bottle, can or tin.
A unit article, i.e. loaf of bread, loose stack of newspapers or cardboard cartons in flat form.
A unit load, i.e. pallet load of cartons or cases.

General Requirements of Package to Speed Handling

Careful selection of container design.
Consideration of size, weight, shape, stability, friction factor.
Tight specification, uniformity of outer covering.
Close inspection, at manufacturer's, at producer's, on re-used containers.

Building and Plant Layout, Works Method, Works Study

New buildings:
Settle details of product and package.
Settle layout of raw materials store, productive plant, handling equipment and finished goods store: work method.
Arrange for minimum material moving: work study.
Study merits of continuous flow versus picking up and putting down.
Avoid abrupt changes in direction.
Old buildings:
As far as possible, procedure as above.
Consider building alterations after planning plant and equipment.
Take specialist's advice at all times and save yourselves headaches and money.

Fig. 1. Plain chutes for gravity roller receiving tables

*British Wedge Wire Co., Ltd. A paper presented to the N.W. Division of the Institute of Materials Handling of which Division Mr. Leech is Chairman.

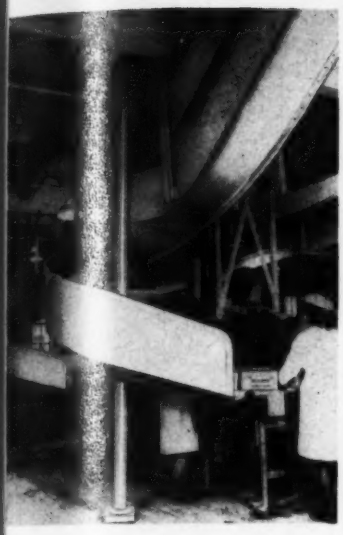


Fig. 2. Spiral chutes for cartons

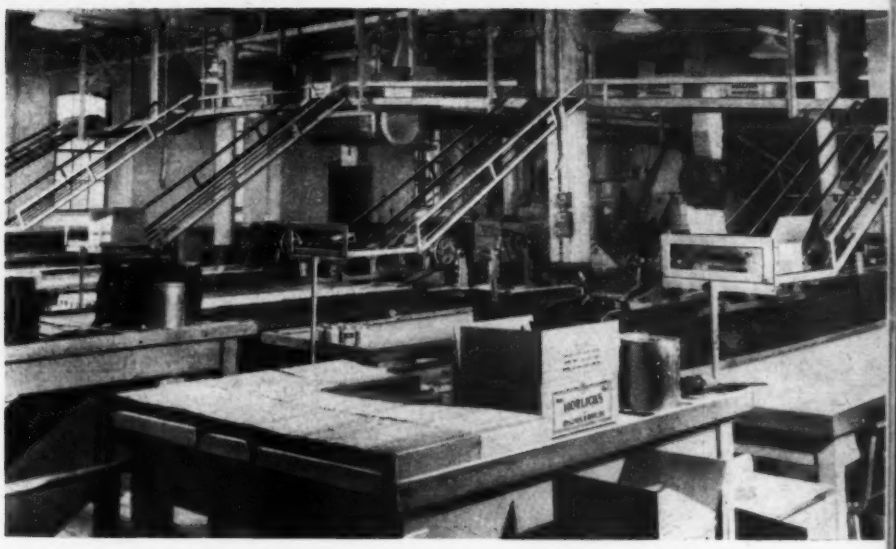


Fig. 3. Spider chutes for cartons

Bear in mind the wide application of basic forms of mechanical handling equipment, some of which are listed below.

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(*a*) Chutes.
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Fig. 4. Side feed and discharge lowerator handling beer crates

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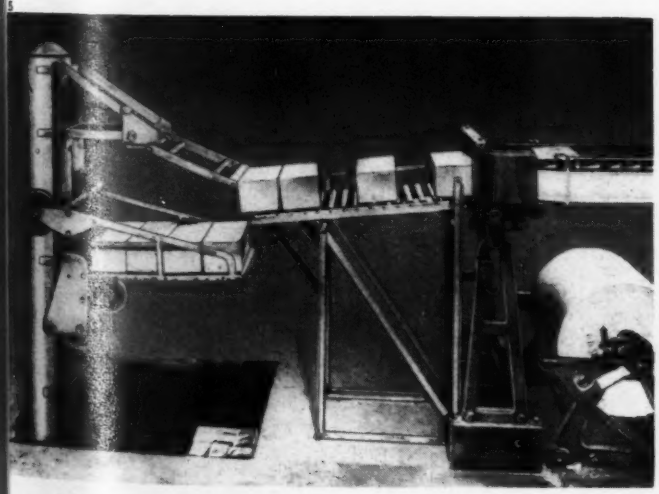

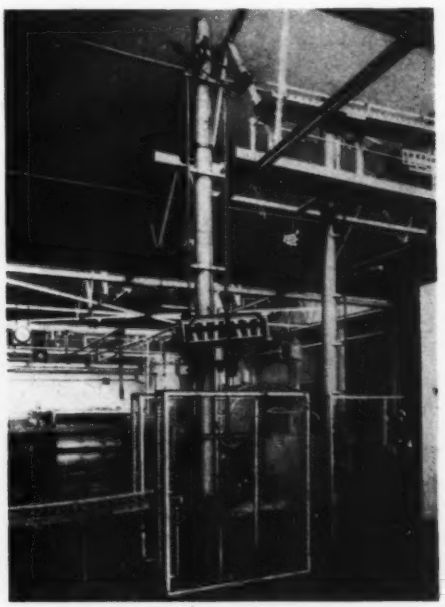

PACKAGE HANDLING

Dealing with some typical types of equipment for handling a parcel or object with outer covering, cardboard cartons, wooden cases, bottles, cans or tins; also unit articles such as a loaf of bread, stack of newspapers or periodicals, or cardboard cartons in flat form. The article is based on the author's lecture notes. A future article will deal with Package Handling by industrial power trucks.

By J. W. LEECH*

MECHANICAL HANDLING is a service of wide character; it affects everything we eat, wear or use. Besides the mechanical side there is the human relation side, most important in modern management.

Mechanical handling has been within our grasp for centuries, but has only been developed within the last century, through availability of new sources of power, and with ingenuity in applying age-old aids to moving objects.

Objects and Advantages of Mechanized Handling

With the use of mechanized handling we make better use of labour. It enables us to redirect labour from unproductive to productive jobs. It takes unnecessary effort out of labour, and brain-work out of repetition work.

With it we can reduce the time lost caused by accidents.

At a recent lecture given in London by the Chief Engineer of the Government Factory Inspectors, he told his audience that 27 per cent of 50,000 accidents which happened in factories each year were due to normal handling, or rather mishandling. This represents 20,000,000 man-days lost per year which is equivalent to a cost against industry of £70,000,000 per year.

This is a very heavy bill to industry which can be saved by the introduction of mechanical handling devices. It will reduce the damage to goods and cause less fatigue. Mechanical devices are more foolproof and reliable than manual labour.

Smaller raw material stores will save space and, with high stacking, give us the use of roof space.

It will increase the amount of production and decrease the cost of production. By this method we shall obtain greater use of space in manufacture and finished stores.

Consideration of Costs Involved

Cost of capital equipment.
£2,500 to redirect one manual labourer from unproductive to productive job.
Normal equipment should repay capital cost in three years.
Maintenance costs.
Higher with electronic devices compared with mechanical devices.

What is Meant by a Package?

Definitions:
A parcel, or object with outer covering, cardboard carton, wooden case, bottle, can or tin.
A unit article, i.e. loaf of bread, loose stack of newspapers or cardboard cartons in flat form.
A unit load, i.e. pallet load of cartons or cases.

General Requirements of Package to Speed Handling

Careful selection of container design.
Consideration of size, weight, shape, stability, friction factor.
Tight specification, uniformity of outer covering.
Close inspection, at manufacturer's, at producer's, or re-used containers.

Building and Plant Layout, Works Method, Works Study

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Settle details of product and package.
Settle layout of raw materials store, productive plant, handling equipment and finished goods store: work method.
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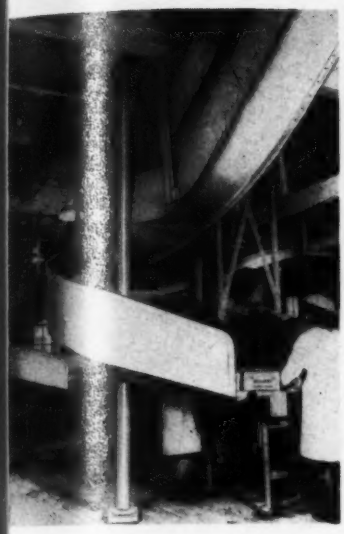

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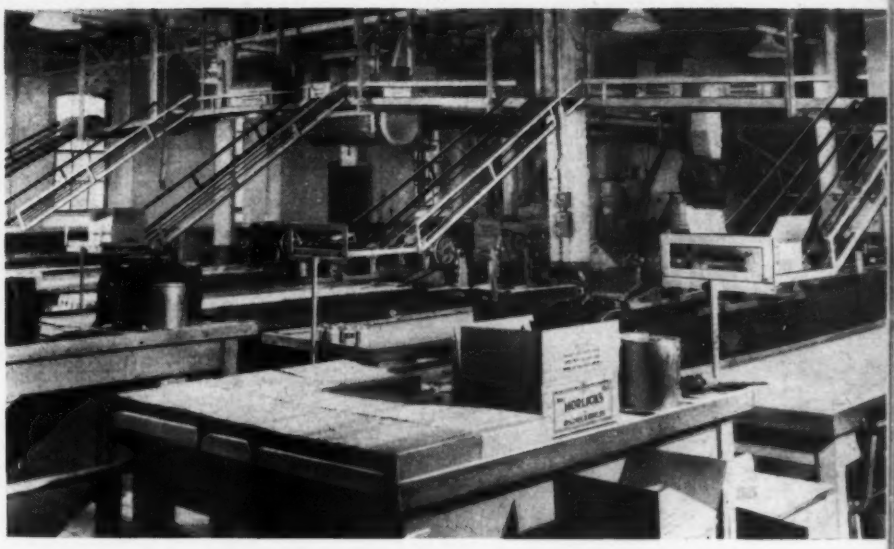

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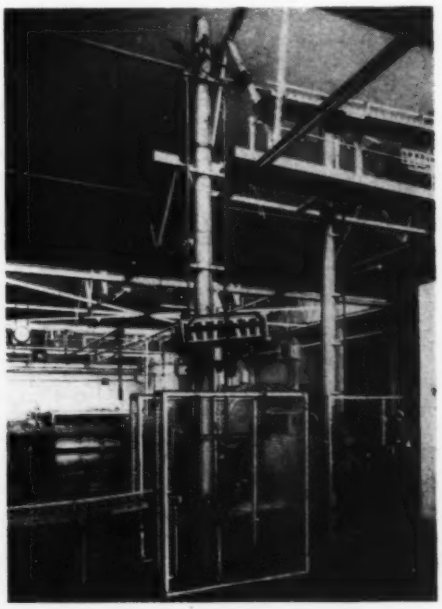
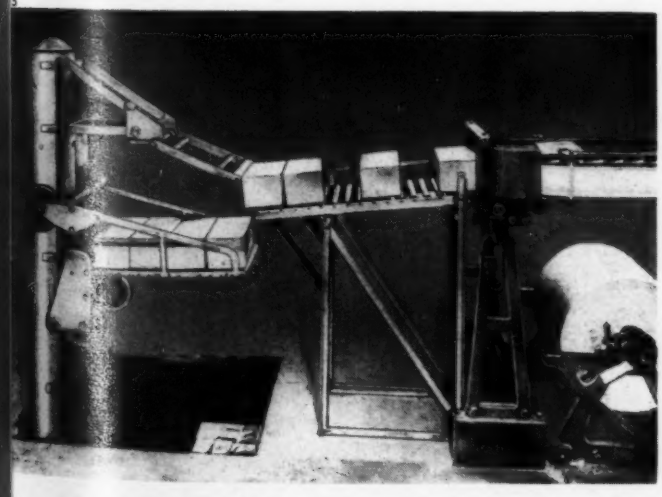




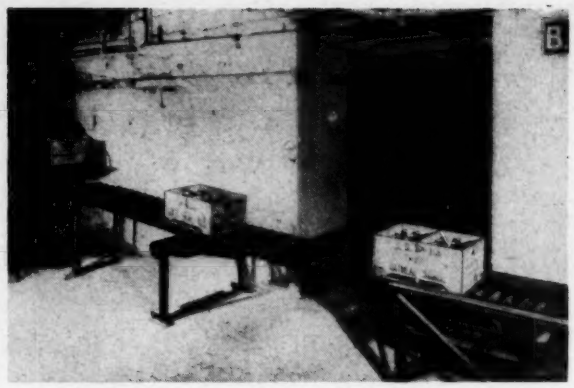


Fig..6. Gravity roller conveyor showing hinged section for doorway

to suit a selected weight and size of the load and therefore packages must be more or less uniform.

In the event of a variety of sizes in weights and cases being handled, either a number of chutes, each handling one size, are necessary, or some other form of conveyor should be used.

Components: Various forms of brakes are used to slow cases down at the bottom of the chute but the best way is to use a chute of the right gradient for the size and weight of the article.

Chutes may be made of wood planks or metal troughs and they may be made straight or spiral. They can also be made up in the form of what are called skeleton chutes where tubes or narrow flats are made up into a framework.

They are, of course, the cheapest form of mechanical handling equipment and should be used wherever space is available and the type of package is suitable.

Non-powered Vertical Lowerators

Application: Where the drop required is considerable from one floor to another or is through several floors compared with the horizontal space available which may be restricted due to machinery on other floors, then for loads of equal size and having a variation of weight of not more than 2:1 and a minimum load of not less than 30 lb, the Aircush type lowerator is one which has been found by breweries and general industry to be very reliable and give long and efficient service since it was introduced about 10 years ago.

Components: This unit consists of a vertical tube which forms the main framework, and a carriage which carries the loads is arranged to run up and down, controlled by rollers in contact with vertical tubular tracks fixed to the tube. Inside the tube there is a piston, the weight of which counter-balances the weight of the carriage. The piston and carriage are connected together by a rope passing over a rope sheave in the head of the tube.

The piston and tube act as a compression stop, so as to slow up the travel of the carriage as it reaches the top loading and bottom discharge positions.

The load, which is allowed to run on to the carriage by gravity, creates an out-of-balance load in relation to the piston and down goes the carriage. The carriage drops rapidly until nearing the bottom when it slows up. The load runs off automatically and back goes the carriage to the top where it slows down as it comes into the load position and picks up the next load. These lowerators are made with side feed and discharge or front feed and discharge and can carry one or more cases at a time, provided suitable selection devices are fitted on the feed conveyor.

Capacities: To give an example of speed, for a 10 f 300 carriage drops an hour are possible and, if two ca carried each time, this means 600 per hour or, wit cases, 1,200 per hour.

Maintenance: The only maintenance cost is the repla of the rope which is recommended twice a year and only a matter of a pound or two; the tube and rope rollers should be kept well lubricated.

Comment: After 10 years, original installations a doing 3,000 drops per day.

Roller and Wheel Conveyors, both Gravity and Pow

Application: Roller and wheel conveyors are mainl for the horizontal movement of loads without pow they are one of the most widely used forms of co equipment as they are comparatively cheap to instal to reform into different schemes and are therefor flexible in their application, and, provided the right c roller is selected for the items being handled maintenance cost is fairly low.

They are used for handling hard-bottomed article long distances with a fall in the track usually varyi about 3 deg to 5 deg.

If combined with small powered humpers for the loads up to a suitable height for a further leng gravity roller track, when the gravity rollers get near floor level, the extent of travel is then almost unlimite

Corners can be negotiated by taper roller bends alth it is often difficult to get packages to pass round corners without twisting, which sometimes causes dif when feeding other forms of mechanical handling e ment from the end of gravity roller conveyors.

With regard to limitations, these are much the same chutes, i.e. the loads carried should be uniform in w although they can be of varying size and a limit of a mum of 100 lb is often quoted otherwise there is a ten for the loads to run away or to stick because it is di to arrange the angle of incline with sufficient accura obtain a uniform motion as the loads get heavier.

Where sacks are handled on gravity rollers they mu hard filled and small rollers closely spaced should be

Components: Originally all gravity roller conveyors made up with tube rollers with non-precision bearin each end.

Whilst this form is widely used, in more recent yea roller-race-type track with a series of roller races mo on spindles so that they are staggered on adjacent spi makes a lighter form of track which is favoured when track has to be transportable.

Tracks are normally mounted on adjustable h frame legs so that the gradients can be adjusted acco to the articles handled.

With regard to the spacing of the rollers, it is esse that there should be at least three rollers under the leng the package which you are handling.

In dusty atmospheres grease sealed rollers shoul used. These normally have a better-quality bearing the more common type of roller track but, as I stressed before, with conveyor equipment it is always important to obtain the right type of equipment rather skimp on the first cost.

Maintenance: Maintenance is simple as it only inv lubricating the roller bearings, keeping the tracks rea ably clean and, if side guides are used to prevent box cases from leaving the tracks, seeing that these straightened out from time to time if they become The level alignment of the conveyors should also maintained for efficient service.

Comments: These gravity roller conveyors are gene

considered the cheapest form of conveyor and can be adapted for many and various uses but should not be considered as being suitable for a continuous positive flow of articles unless ample gradients are available.

They do, however, save a lot of unnecessary labour and a lot of fatigue in labour and should always be considered first before powered conveyors.

Powered Roller Conveyors

Application: These are for handling similar articles to gravity roller conveyors but where the down gradients are not sufficient to allow gravity roller conveyors to be used.

Components: It is now common practice to adapt a gravity roller to a powered unit by fitting, underneath sections of gravity roller track, what is virtually a narrow rubber belt conveyor with the top strand of the rubber belt kept in close contact with some of the gravity rollers at intervals along the top strand by snubbing rollers, the rubber belt being supported on the return strand by further rollers.

The drive for the rubber belt conveyor is mounted underneath the feed end of the roller track as the rubber belt runs in the opposite direction to the direction of travel of the cases on top of the powered roller conveyor.

The writer has recently seen this type of unit used throughout the Carlsberg and Tuborg Lager Brewery bottle-washing and filling installations. One advantage is that the cases, if held up in front of any machine, can stack up one behind the other whilst the powered rollers are still rotating underneath them quite freely.

Maintenance: It was, however, confirmed that the rubber belt has to be replaced fairly frequently and also the rollers, both on the top roller track and those holding the rubber belt against the top rollers, as they receive fairly hard wear through the constant pressure being applied and the friction under the cases when the latter are stopped on top of the conveyor.

Where the cases have to pass round 90-deg and 180-deg corners on these two installations, taper roller corner conveyors are used, driven in one case by means of a 'V' rope in contact with the outer edge of the underside of the taper rollers held against the top rollers by other shub rollers in a similar manner to the straight conveyors.

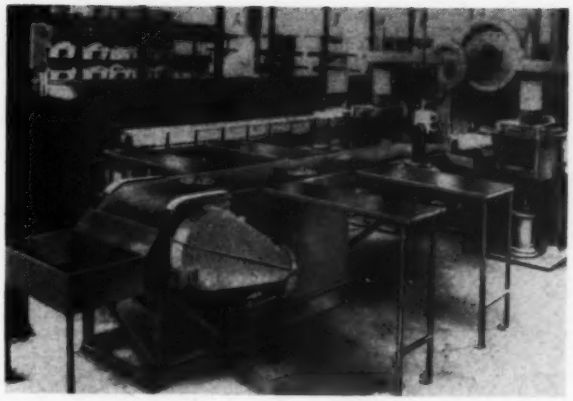


Fig. 7. Assembly bench conveyor

Fig. 8. Carton conveyor

Fig. 9. Sack conveyor

In the other case taper rollers have flanges on the outer ends which are coned and contact the coned face of vertical rollers and are driven by friction between the two surfaces, the vertical rollers being spring loaded upwards and driven by 'V' rope drives in the vertical plane.

Both these units appear to work quite well but require frequent replacement of the 'V' rope drives.

They do not, however, get away from the difficulty of the cases tending to turn as they go round the corner and, therefore, when they come on to a straight conveyor vertical powered belt conveyors have to be used to line them up before entering machines.

Comments: From these remarks concerning powered roller conveyors it will be appreciated that, in the writer's view, whilst they are quite efficient, maintenance costs are always present and their first cost must necessarily be higher than an ordinary belt conveyor as a greater number of rollers have to be used for supporting the loads and as they are powered it is necessary to use grease-filled rollers throughout.

They have the advantage that the surfaces carrying the loads are not lubricated and, therefore, they are a clean type of conveyor.

Flat Belt Conveyors

Application: Flat belt conveyors are one of the most widely used forms of powered conveyor as they can be adapted for handling both small and large individual unit

Fig. 10. *Inclined gripface belt conveyor*

articles such as cases, metal drums, cartons, tins, cans, bottles and even match-boxes or biscuits to give some of the wide variety of articles which are carried on them. They are also used in industry for handling many articles in process applications from the manufacture of cycle or car parts to plastics or pottery.

Components: It is of importance that the correct type of belt should be chosen for the articles to be carried. The cheapest form is, of course, the canvas belt and for many light articles this is very adaptable.

Then there is the Balata type belt which is a waterproofed canvas belt and more robust and, alternatively, the rubber and canvas belts and finally, in the last decade, wire belts have been coming to the fore and they have considerably increased the range of application of belt conveyors.

Let us first take canvas, Balata and rubber conveyors.

These can be used where the articles are not sharp or too hot or where the belt does not become foul or absorb fats or other ingredients as found in the bakery and confectionery trades. In regard to rubber belt conveyors, in addition to the ordinary smooth surface rubber belts of recent years there has been an introduction of a rough surface rubber belt which is extremely efficient in handling light and medium weight packages up or down inclines.

Material carried	*Angle of inclination*
Card, fibre, boxes and cartons	30 deg
Tins, wooden crates, etc.	28 deg
Sacks (loosely packed)	35 deg
Cement in paper bags	30 deg
Bundles of paper	28 deg
Sacks of flour	30 deg

These figures are conservative and in many cases can be exceeded.

Fig. 11. *Table of inclines*

The angles of inclines that can be negotiated with various articles are as shown on Fig. 11. If plain-faced rubber belts are used inclines would be about 10 deg less or with plain wire belts about 20 deg less. Terminal or deflection pulleys for these belts should have crowned faces as they are driven under tension and the crowned face helps to maintain the alignment of the belt.

In addition to the normal head which is usually a main pulley with a snub pulley or two pulleys in tandem, it is preferable to have a tension device which applies a constant tension to the belt. This can be either weight or spring loaded and is necessary to make an efficient drive. Excessive tension, however, should be avoided and it is better to use a more efficient drive than to overdo the tension.

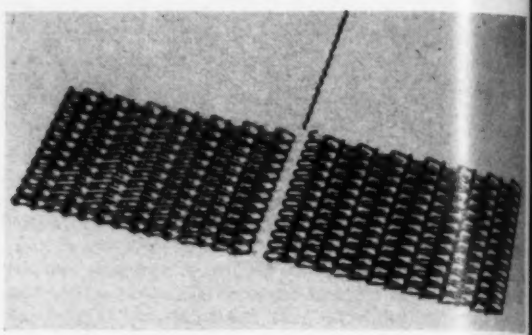


Fig. 12. *Open mesh belt showing join*

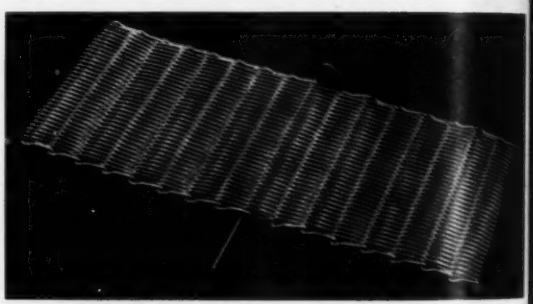


Fig. 13. *Close mesh belt showing join*

Wire Belts

Application: Now let us turn to woven wire belts which can be used equally well and in most cases quite as economically when compared with Balata or rubber belts for most of the above-mentioned applications and have a wider sphere of applications because they are capable of being used on very long conveyors without large terminal pulleys being required for drive heads.

They can also carry very heavy loads and hot loads which would cause deterioration in any other form of belt and then, again, due to the fact that they can be made either in a close or open mesh, they can be used for handling a wide variety of sizes of articles and, at the same time allowing a free flow of air, water or chemical circulation which is required in many industrial processes which necessitates a conveying medium in order to deal with the capacities involved.

One of the advantages of woven wire belt conveyors is that the wire belts do not require lubrication and therefore the surface of the belt remains clean. Furthermore, if the correct type of wire belt is selected, flat hard-bottomed

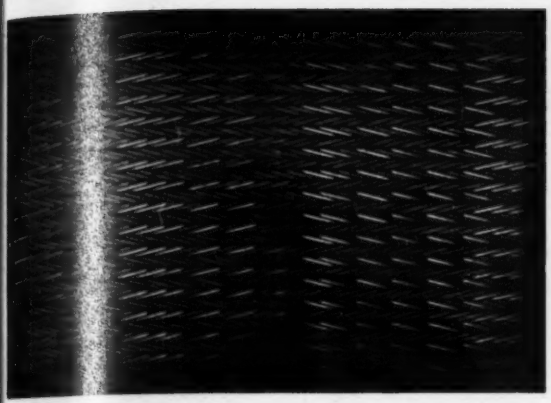


Fig. 14. Very close mesh belt

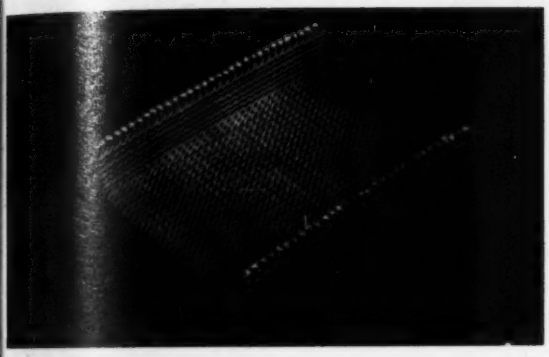


Fig. 15. Belt with turned-up selvedge

articles, such as cases of beer, will slide freely over the surface, i.e., the belt can go on running if a line of bottles or cases has stopped without a great deal of friction or wear occurring.

Therefore, this type of conveyor is cheaper as it involves fewer parts and is equally as efficient as powered roller conveyors. It can also be used for going round corners of 90 deg and 180 deg and because of the smooth surface and small terminal pulleys articles, such as bundles of newspapers, can be transferred from one conveyor to another.

Components: For handling a very wide variety of articles there are almost an equal number of different types of weaves from the very open weave to very close weaves. The surface of the belts can also be made very flat.

Belt pitch, of course, varies with the mesh but the smallest pitch belts can go round ¼-in dia. rods and there are quite a number of applications which use 2-in or 3-in dia. terminal pulleys, but normal applications have ½-in to 1½-in pitch belts.

As with canvas belts, woven wire belts can either be supported on skids or on rollers. If skids are used the chevron grid type is preferable as it ensures even wear over the underface of the belt and helps to align the belt. Relieving rollers can be fitted between the grids if required.

If the belts are supported on rollers the alignment of the rollers is important and the spacing should not be too far apart, particularly where heavy loads are concerned which might tend to bump over the rollers and nip the belt. With regard to guiding the belts, the importance of true alignment and levelling of all belt supports and of the terminal pulleys cannot be overstressed.

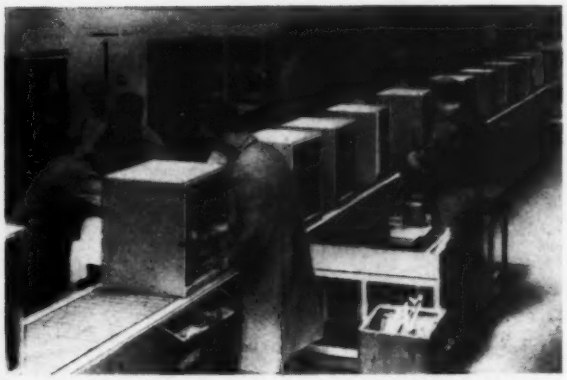


Fig. 16. Television set assembly conveyor

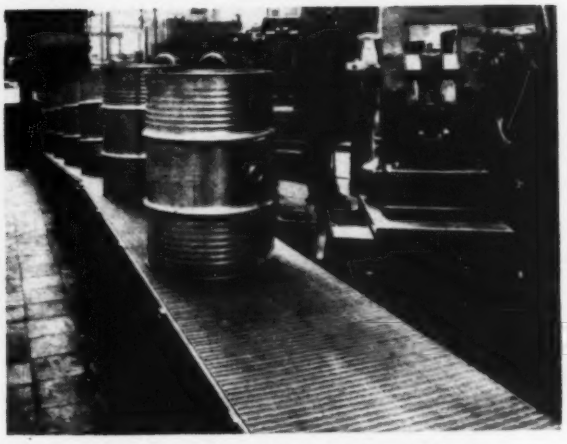
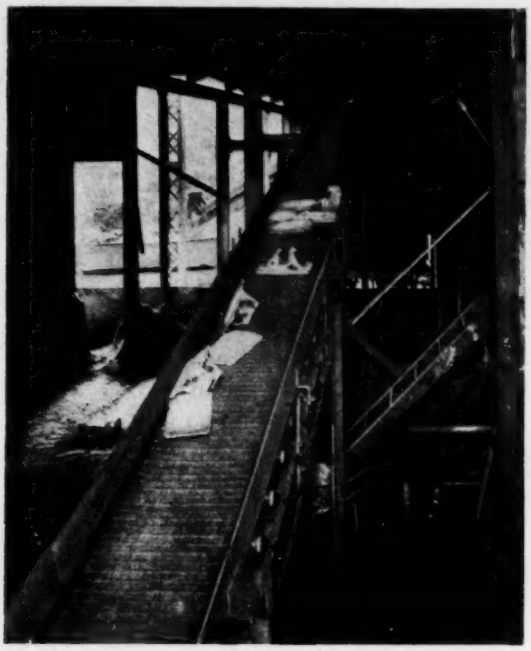


Fig. 17. FS belt handling metal drums during manufacture

Fig. 18 (above). 500-ft-long floor level belt conveyor

Fig. 19. Heavy-duty FS belt handling foundry moulds during cooling operation



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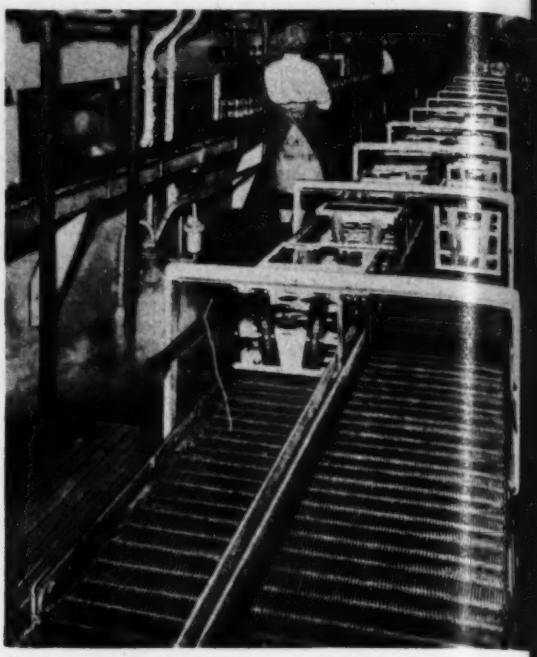

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Fig. 20. Heavy FS belt conveyor handling red-hot castings as they come from the shake-out

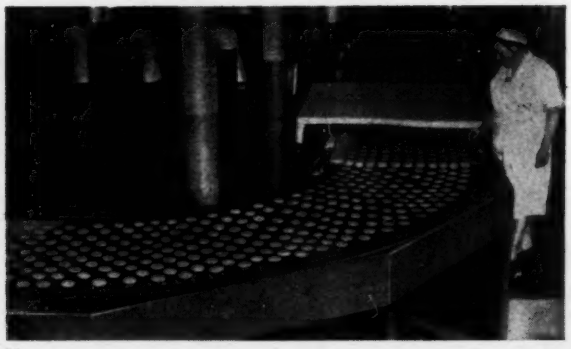
Fig. 21. FS belt conveyor handling bottle crates in breweries, the crates being empty and ready to receive bottles after filling. The same type of conveyor is used in the cellars of the breweries where the stilling takes place

Fig. 22. Narrow belt conveyors made in stainless steel for handling bottles between washing, filling and capping operations and filling, pasteurising and labelling machines

Fig. 23. 90-deg corner conveyor handling biscuits

Fig. 24. 180-deg corner conveyor handling sacks

Fig. 25. 90-deg and straight conveyors handling loose bundles of newspapers



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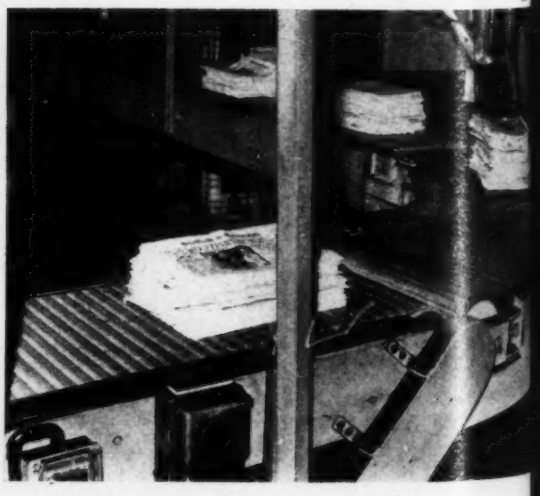

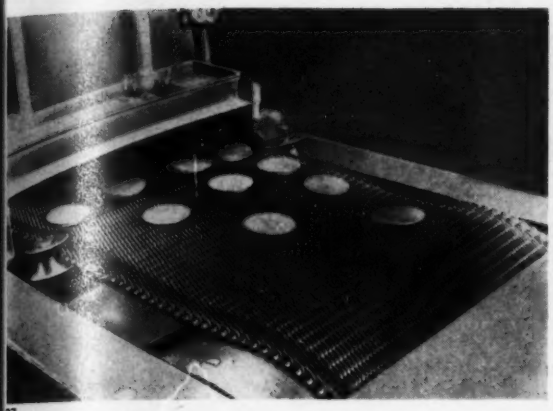

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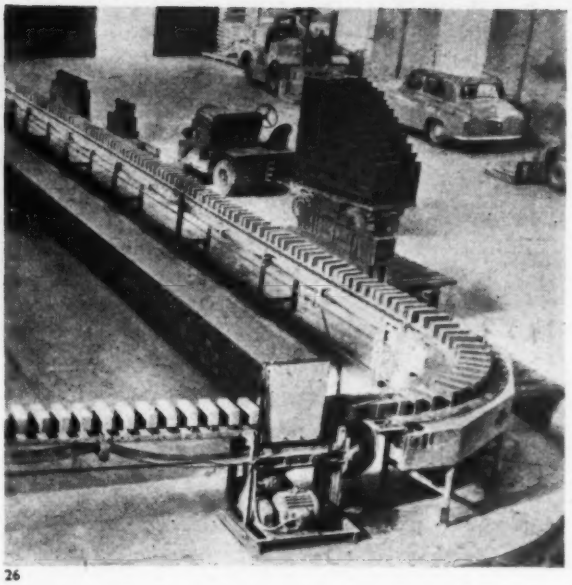
Fig. 26. *90-deg and straight wire belt conveyors handling bricks before baking*

Fig. 27. *Guidlers trimming belts as they enter furnace*

Fig. 28. *Chevron grid-type belt supports*



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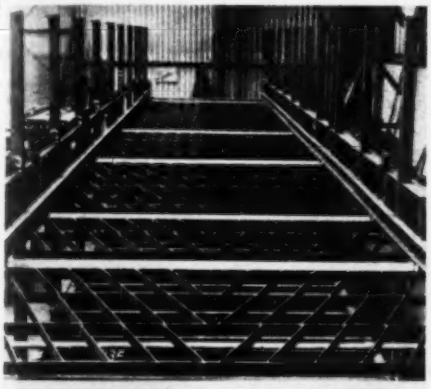

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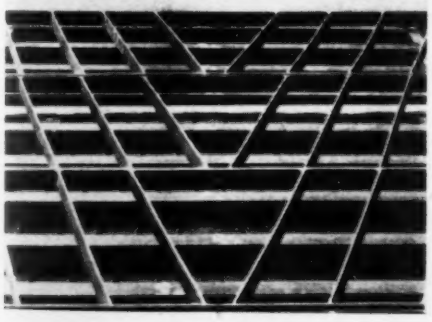
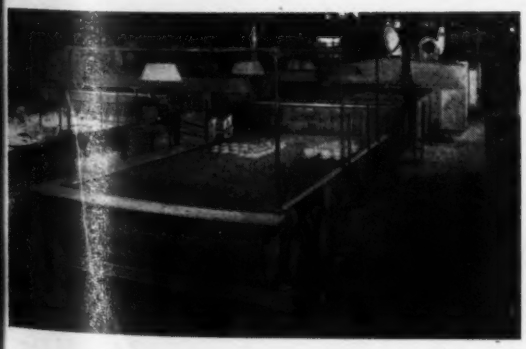


Fig. 30. *Tandem drive*



If side guides are used for belt conveyors they should be continuous the whole length of the belts and fairly close to the edge of the belt. This relieves the amount of pressure that the belts can exert at any one point along the side guide. Wire belts have the added advantage that they can be centre-guided by rollers underneath the middle of the belt.

The guidlers previously referred to can be used for side guiding belts on the return side and for easing the belts in between fixed guides on the loaded side. Automatic belt trackers are also used under difficult conditions where the tension in the belt has, of necessity, to be greater than normal due to drive rollers not being lagged.

Any belt, and wire belts in particular, will always be easier to track and run more truly if a positive drive is used with as little tension as possible.

Fig. 29. *Flat surface belt conveyor with chevron grid supports*

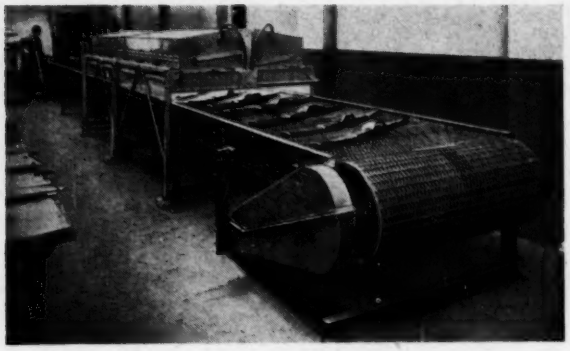


Fig. 31. Centre guide rollers used on infra-red drying oven with open mesh belt

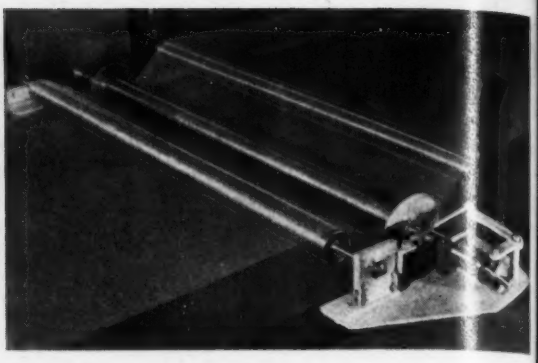


Fig. 32. Patent automatic belt trimming device

Causes for the bad tracking of friction-driven belts may be summarized as follows:—

(1) Over-tension.
(2) Badly made joints in the belt.
(3) Malalignment of terminal or deflection pulleys or support rollers.
(4) Incorrect levelling of belt supporting rollers or skids.
(5) The build-up of material on roller supports or skids under one side of the belt.

The types of drive used are similar to those with rubber and canvas belts except that the drive pulleys must have flat faces and the snub pulley is usually spring loaded against the drive pulley, both drive and snub pulley being rubber covered.

For very long conveyors, rubber-covered rollers driven in tandem are used. One particular conveyor is 500 ft long and driven by 15-in dia. pulleys in tandem and another is 750 ft long and driven by 18-in dia. tandem pulleys.

Capacities: Loading on these long wire belt conveyors is in the region of 2/3 tons respectively.

Maintenance: If maintenance is directed to taking care of the causes given above for bad tracking and provided the edges of the belts, whichever type they may be, are watched and kept in condition, belt conveyors will give long and economic service.

All other types of maintenance are common to most conveyors with regard to drive and tension units.

Comments: In general, belt conveyors are the cheapest form of power-driven package conveyors with the widest application and they should, therefore, be considered first before any other type whether carrying goods horizontally or lifting them up inclines.

In regard to the inclined conveyors they can carry a far greater capacity in number of articles per hour than any vertical elevator.

(To be continued)

Crane Manufacturer's Bold Move to Combat Overseas Trade Barriers

STEEL & CO., LTD., Sunderland, has made an offer to buy the whole of the ordinary stock of R. H. Neal & Co., Ltd., of Ealing and Grantham, makers of the well-known Neal mobile crane. The same company also reports the purchase of the crane business of F. Taylor & Sons (Manchester) Ltd., makers of the Taylor Jumbo mobile crane.

As Steel & Co., Ltd., already owns the whole share capital of Steels Engineering Products, Ltd., manufacturers of the famous Coles mobile cranes, it will control three of the largest British manufacturers of mobile and rail cranes.

The object of this amalgamation is to combat the aggressive bid of Continental crane manufacturers for world markets. In anticipation of the European Common Market manufacturers in Germany and France have been closing their ranks and rationalizing their production which puts them in a favourable position to compete with the larger but less integrated British industry.

The three manufacturing companies will continue to produce their individual and distinctive models in their own factories and will trade as entirely separate entities competitively in Great Britain. In foreign markets, however, the resources of the three factories will be pooled for maximum advantage in securing the greatest possible share of available world business.

Considerable economies in design and manufacture are eventually anticipated as the products of the three companies are gradually rationalized.

Herbert Morris, Ltd. and Steels Engineering Products, Ltd.

IN the interests of rationalization of manufacture Herbert Morris, Ltd., of Loughborough, and Steels Engineering Products, Ltd., of Sunderland, have entered into a reciprocal agreement whereby Morris mobile, truck-mounted and rail cranes will in future be manufactured at the Sunderland factory, and Coles overhead travelling cranes and electric hoists will in future be manufactured in the Loughborough factory. The directors of the two companies are confident that this arrangement will increase the efficiency and economy of manufacture and thus be in the best interests of their customers. The Morris and Coles products will continue to be marketed and serviced separately at home and abroad as hitherto and no changes in staff are contemplated as a result of this exchange of manufacturing capacity.

DEMONSTRATION

NEW FREIGHT SERVICE FOR UNIT LOADS

Cross-Channel Facilities between Belfast and Liverpool

A COMPREHENSIVE vehicle and container service between Liverpool and Belfast was opened recently by a new company known as Link Line, Ltd.

The new organization has acquired two motorships from the Zillah Shipping Co., Ltd.—*Brentfield* and *Birchfield*—which have been renamed *Spaniel* and *Pointer*; new quay facilities have been built at Liverpool and Belfast and include a Butters 15-ton s.w.l. crane at each port; a range of aluminium containers with a capacity of 12 tons each have also been specially designed for the new service which will operate nightly in both directions.

A spokesman for Link Line, Ltd., said that the new company is providing a regular service for unit loads of all types—vehicles, trailers, large containers, Lancashire flats, bulk liquid tanks and other similar units—which it was felt would help shippers whose traffic could benefit from door-to-door transit.

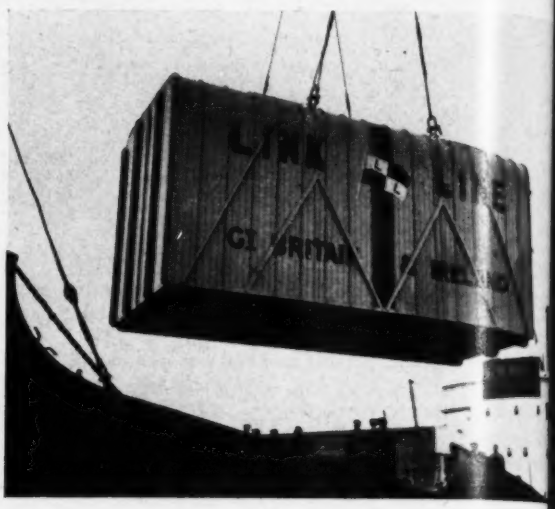
As there are no tidal restrictions at Belfast and the Waterloo Dock at Liverpool allows berthing at any state of the tide, the ships will be able to make an overnight passage and begin discharge at both ports at 8 a.m. daily. For natural reasons, Liverpool and Belfast have always handled a large proportion of the trade moving between England and Northern Ireland, because both ports lie close to main manufacturing centres.

While Link Line can supply the latest type of containers, each capable of carrying 12 tons of goods, the company realizes that some shippers may prefer to use trailers or

View of loading berth at East Victoria dock, Liverpool, showing the Butters 15-ton crane and the motorship 'Pointer'

A loading skid is employed for loading semi-trailers aboard ship, as seen in this photograph

BELOW
One of the new 12-ton Link Line aluminium containers being loaded by the Butters crane



Lancashire flats, while others will require insulated containers. At the outset it is the company's intention not only to handle such loads but to develop their resources flexibly in order to meet any new trends. The company's containers can be sent to customers' premises for filling and subsequent door-to-door delivery.

To ensure a comprehensive service Link Line has already made arrangements to work in co-operation with the Belfast Steamship Co., Ltd., and the Belfast, Mersey and Manchester Steamship Co., Ltd., who, between them, provide two general cargo sailings each day between Liverpool and Belfast and have special facilities for the smaller type of containers of up to 4 ton capacity. Through these organizations the new company will meet the needs of shippers who offer traffic which is not suitable for unit loading.

At Liverpool the company's loading berth is at East Victoria Dock while at Belfast the terminal is at Spencer 'A' Quay.

The *Pointer* was built at Ardrossan Dockyard in 1956 and the *Spaniel* by George Brown, Greenock, in 1955. Both are approximately 224 ft long with beams of 37 ft 6 in. The tonnage of each is about 1,265 gross while the propelling machinery is Clarke-Sulzer type TD.36 diesel of 1,260 b.h.p. giving a service speed of 11½ knots. The vessels are equipped with radar, radio-telephone, Decca Navigator and echo-sounding equipment to aid speedy and safe operation.

Since they were acquired by Link Line the two ships have been converted for their new trade at Ardrossan Dockyard. The interiors have been reconstructed so that there is one hold of 130 ft which is free of obstruction in which trailers or large-type unit loads can be stowed four abreast. Thirty-six such units can be carried by these ships.

The names of the two vessels have been revived from two which were in the fleet of the old Scottish company, G. J. Burns.

Headquarters of the new company will be at Ulster House Donegall Quay, Belfast, while the Liverpool agents are Coast Lines, Ltd., Reliance House, Water Street.

LEFT
A 'mechanical horse' positions the loaded trailers in the ship's hold

DEMONSTRATION

A VERSATILE TRACTOR-SHOVEL

Matbro Mastiff Demonstrates its Exceptional Manœuvrability

By a Staff Reporter

ON A BITTERLY COLD MORNING, a group of industrialists and civil engineers from the fighting services and public works contracting firms assembled on the Beddington and Wallington Corporation's tip at Beddington Lane, Croydon, and ignored, and sometimes forgot, the biting wind as they watched an ace driver demonstrate the handling qualities of the 'Matbro Mastiff'.

Shortly before this demonstration, at the Public Works and Municipal Services Exhibition, Mathew Brothers, of Wallington, had shown their most recent version of the 'Mastiff', a tractor-shovel powered by a 6-cylinder Ford engine developing 96 b.h.p. and exerting a bucket breakout force of 17,000 lb, as reported on page 27 of the January issue of *Mechanical Handling*. One of the new 6/90 models, which was being run in prior to delivery to a customer, was seen travelling at speed along the road and manœuvring on clean ground, but the machine used to illustrate the characteristics of the 'Mastiff' was the original two-year-old prototype of the 62 h.p. 4/60.

During the two years since it was built, this pre-production machine has been in constant use, engaged principally on the gruelling task of showing prospective customers how much punishment it could take. It is immediately identifiable by the original welded gearbox and other fabricated units, which were replaced by castings when the machine went into production. Since then, the original design has been improved upon in a number of details.

Bucket and arm motions have been modified in the current version to give a 51-deg rollback at ground level and a discharge angle of 63·5 deg at maximum lift, with a lift height of 9 ft under the tipped bucket and a maximum outreach of 6 ft 4 in. In the improved design of the arm linkages there is greater protection for the driver, and this is reassuring. It was quite alarming to watch the great arms swing down so close to the demonstrator of the prototype, though, in fairness, it must be stated that experience has proved the potential danger to be more apparent than real—for many drivers, large and small, have operated the machine and none has been injured or even felt himself to be in danger.

Two years ago, when the original 'Mastiff' was developed, it was claimed to be the first British-built 4-wheel-drive loading shovel. The design principles underlying this feature—and, indeed, the design as a whole—have remained unaltered, and the prototype achieves a degree of manœuvrability and tractive effort that would be hard to better in a wheeled tractor with an engine of equivalent horsepower.

At the demonstration, as our pictures show, the machine was put through its paces. It handled loose earth and hardcore and large blocks and beams of concrete; did a stint

At the Beddington and Wallington Corporation's tip, the 'Matbro Mastiff' digs a deep hole and climbs out with bucket laden to its full 1·5 cu. yd. heaped capacity. With four-wheel drive and torque converter transmission, tractive effort is fully maintained

LEFT
Stopping and starting on a 1-in-1 gradient and on loose ground was effected without a trace of wheelspin

BELOW
With a breakout force of 11,000 lb, the 'Mastiff' strips the surface of the well-consolidated approach track to the tip as though it were powdered tilth

on dozing, stripping, and grading; dug itself into and out of a deep pit, emerging always with a full shovel-load of excavated material; stopped and started, fully laden, on a gradient of about 1 in 1; and rode over loose earth, mud, and mounds of rubble. Unfortunately, there is no picture to illustrate one of the 'Mastiff's' most valuable characteristics: the ability to turn at right angles in intersecting aisles of 106-in width for digging or loading.

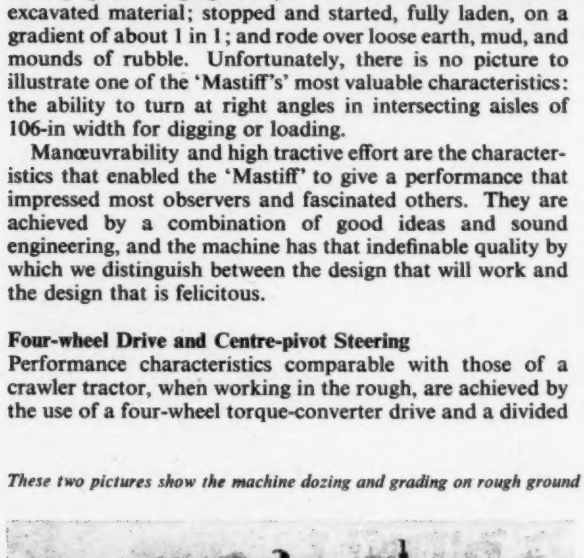
Manœuvrability and high tractive effort are the characteristics that enabled the 'Mastiff' to give a performance that impressed most observers and fascinated others. They are achieved by a combination of good ideas and sound engineering, and the machine has that indefinable quality by which we distinguish between the design that will work and the design that is felicitous.

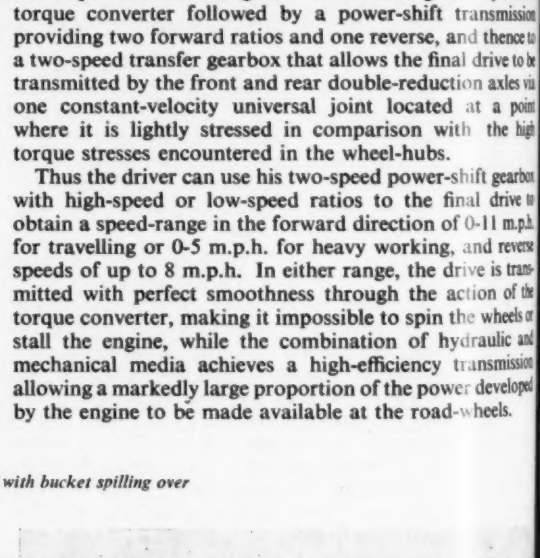
Four-wheel Drive and Centre-pivot Steering

Performance characteristics comparable with those of a crawler tractor, when working in the rough, are achieved by the use of a four-wheel torque-converter drive and a divided chassis with central articulation. The drive from a 4-cylinder 62-b.h.p. Ford diesel engine is taken through an hydraulic torque converter followed by a power-shift transmission providing two forward ratios and one reverse, and thence to a two-speed transfer gearbox that allows the final drive to be transmitted by the front and rear double-reduction axles via one constant-velocity universal joint located at a point where it is lightly stressed in comparison with the high torque stresses encountered in the wheel-hubs.

Thus the driver can use his two-speed power-shift gearbox with high-speed or low-speed ratios to the final drive to obtain a speed-range in the forward direction of 0-11 m.p.h. for travelling or 0-5 m.p.h. for heavy working, and reverse speeds of up to 8 m.p.h. In either range, the drive is transmitted with perfect smoothness through the action of the torque converter, making it impossible to spin the wheels or stall the engine, while the combination of hydraulic and mechanical media achieves a high-efficiency transmission allowing a markedly large proportion of the power developed by the engine to be made available at the road-wheels.

These two pictures show the machine dozing and grading on rough ground with bucket spilling over





Working and loading soil and hardcore, large lumps of concrete, and reinforced concrete beams, the two-year-old tractor-shovel demonstrates its excellent handling qualities. The driver was using the tips of his fingers to manipulate the controls; often it was only one finger

Higher top-gear ratios will be available in the most recent version of this four-cylinder 62-h.p. 'Mastiff', 4/60, which will be equipped with the same system of torque converter, power-shift gearbox, and transfer gearbox. It will have an overall speed range of 0-17 m.p.h. forward and high and low reverse speeds of 8 m.p.h. and 4 m.p.h. The bucket breakout force on this model is to be rated at 11,000 lb.

Articulation is obtained by splitting the vehicle into two self-supporting structures, each fabricated by welding from heavy profiled steel plate to form a rugged box-type unit, the rear section housing the engine and the front one carrying the driver's cab and lifting arms. These are joined by upper and lower pivot-pins for lateral movement.

Steering is effected by the action of two double-acting hydraulic rams controlled by a conventional steering wheel and supplied with pressurized oil by a pump driven off the engine crankshaft, in tandem with the main pump for the movement of the bucket. The rams are horizontally mounted in the forward section of the chassis, and their heads are attached to pivot-pins carried on the rear section in such a way that the inward and outward movements of the pistons cause the two parts of the tractor to rotate about their pivots. A very light movement is suffiicent to turn the steering wheel from lock to lock in 4 sec and to throw the tractor into a turning radius of 12 ft 6 in, measured to the outside of the wheels, or 13 ft 10 in measured over the bucket.

Quite exceptional manœuvrability is not the only advantage gained by this system. It also conserves the energies of the driver, not only by the lightness of the effort demanded of him but also by reducing the number of turns he has to make to accomplish a given manœuvre as compared with those incurred when using orthodox methods of steering. Further, by eliminating the king-pins, drop-arms, track-rods, drag-links, and hub universal joints of the orthodox steering system, and the stresses induced in them, this simplified arrangement of a pair of rams and a central pivot also saves a lot of mechanical wear and tear.

Axle articulation is another contributory factor toward the achievement of manœuvrability and high tractive force, and was demonstrated by riding over large chunks of concrete. With one wheel some 20 in above the others, adhesion was still maintained and the chassis remained horizontal.

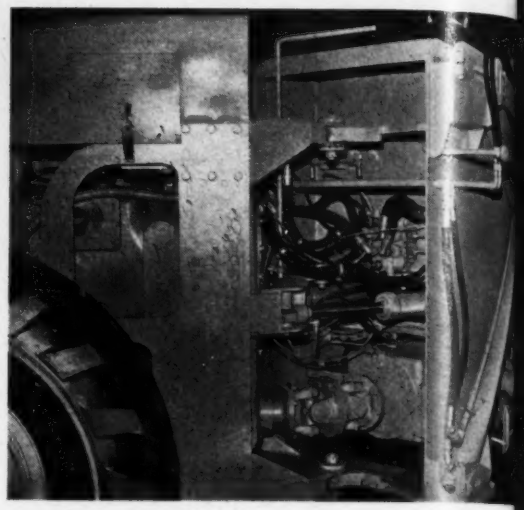
Crawler Performance Plus Speed

In excavation and on loose and sloppy ground, the 'Mastiff' performed like a track-laying tractor. It had the adhesion associated with a crawler, and the sustained and steady tractive effort needed to burrow into masses of rubble containing large chunks of broken concrete and R.C. beams and to push down a wall of heavy ballast, or to strip the surface off the dirt-track consolidated by the wheels of all the traffic using the tip. It has the manœuvrability to dig at 90 deg in a narrow aisle and discharge its spoil like a side-loader.

With the ability to go where a crawler will go, a wheeled vehicle of this type is a tool of much greater versatility than a track-laying tractor. Its four big wheels and high ground-clearance will take it through mud and rubble, and also maintain adhesion on the smoothest of concrete surfaces. The speed-range achieved by the hydro-mechanical transmission is matched by that of the motions effected by purely hydrostatic means. Pressurized fluid is delivered by the main pump at the rate of 30 gal/min to the double-acting rams of 4 in bore that operate the lifting arms and the bucket pivot. Inching facility is provided by a two-spindle control valve and the driver can manipulate his two control levers

ABOVE
Centre-pivot articulation with hydraulic steering and torque-converter drive to all four wheels, 14-in×24-in earthmover tyres front and rear, and high ground-clearance, give this machine the adhesion and manœuvrability of a crawler-tractor, but unlike a crawler it can work on smooth hard concrete as well as in mud

BELOW
Close-up view of central pivot, showing offside steering ram fully extended under control of conventional steering wheel, an arrangement that enables the 'Mastiff' to be turned on a radius of 12 ft 6 in over the outside wheels, or make a right-angle turn into and out of 8-ft 10-in intersecting aisles

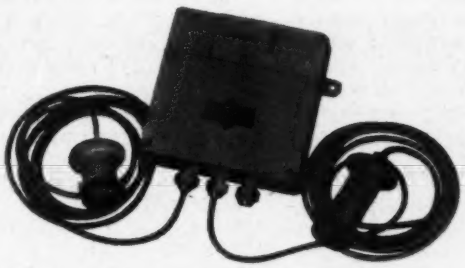


simultaneously to raise or lower the arms or tilt the bucket. Lifting can be accomplished in 7 sec, and lowering in 4 sec; the bucket can be crowded in 1 sec and discharged in 1½ sec. The standard bucket is fabricated from ¾-in rolled steel plate and provided with a replaceable cutting edge of hardened steel, and will take a thrust at the hinge of 8,000 lb. It cleared the front wheels when digging to a depth of 14 in and was able to demonstrate a high rate of output when excavating with a 1·5-cu. yd. bucket filled to its full heaped capacity.

BELOW
At this point in the demonstration, with one wheel about 20 in higher than the others, the driver was asked to 'hold it'

ELECTRICAL ENGINEERS' EXHIBITION

A brief look at some of the equipment to be shown at Earls Court this month



New photo-transistor/counter unit, to be shown by Londex, Ltd.

(Right) New cubicle switchboard (Dorman & Smith, Ltd.)

MORE THAN 430 British firms will take part in the Electrical Engineers' Exhibition, which will be opened by Lord Brabazon of Tara at Earls Court on March 17th. Altogether, more than £2 million worth of equipment will be on show. The Exhibition will remain open until March 21st.

Electrical equipment of virtually every type will be on view. There will also be a special feature devoted to illustrating the educational and training opportunities offered to those wishing to enter the industry. Government departments, the Services, trade associations, technical colleges and manufacturers will join forces in staging this display, aimed at recruiting new blood into one of Britain's most rapidly expanding industries.

In the space available it is plainly impossible to provide a complete preview of the exhibition, but details of a few of the exhibits, based on preliminary information released to this journal, are given below.

The 'inside story' of an interesting selection of rotating plant, instruments, transformers, switchgear and lighting fittings will be seen on the stand of **Crompton Parkinson, Ltd.** Among the new equipment to be displayed will be a sleeve-bearing version of the C.P. series 5 motor, and new panel-mounted miniature instruments.

Most of the other products will be shown in working form. The complete range of 'S' and 'T' series f.h.p. motors will be shown, while a large rotor and stator from an auto-synchronous motor will be among a display of some of the company's larger rotating plant products.

On the **Dorman & Smith** group stand the latest developments in the Dorman system of switchboard building will be on show, and of particular interest will be a new type of cubicle construction. Dorman-type 'TS' switches up to 750-amp rating together with cable accessories will also be exhibited. 'Loadmaster' miniature circuit-breakers, as separate units, and in distribution boards, will emphasize the company's progress in this field of electrical circuit protection, and represent, it is claimed, the widest range in this country.

On the same stand British Klockner Switchgear, Ltd., will show automatic control panels built to consumer's own requirements. Special emphasis will be placed on panels for heat distribution control and automatic lift control panels for all types of passenger, service and goods lifts. These panels are made for motors up to 15 h.p. direct-on-line or 25-h.p. auto stator-rotor starting, also for small passenger or industrial lift controllers, suitable for motors starting direct-on-line up to 2 h.p. on 380-440 V, 3-phase, or ½ h.p. on 200-250 V, single-phase. Visitors will also have the opportunity of seeing the complete range of B.K.S. electrical control equipment.

A varied selection from their extensive range of rotating electrical machines will be exhibited by **Electro Dynamic Construction Co., Ltd.** The display will include vertical pump motors and lightweight battery-driven electric traction motors. There will be an example of the 'Electro Dynamic' magnetic coupling, and typical Admiralty pattern gantry-crane control panels. Other control gear will also be on view, including control desks for the operation of motor alternators for educational purposes.

Exhibits by **Heenan & Froude, Ltd.,** will include a number of variable-speed drives, using Heenan-Dynamatic couplings working on the eddy-current principle, and several new

LEFT
A 'Nife' tripping-unit type T30/10X, for switchgear operation

BELOW
'Davenset' current voltage control battery charger (Partridge, Wilson & Co., Ltd.)

types now available, including a stationary field model with an integrally mounted motor. Various types of electronic control gear will be exhibited which can be made to give the drives different characteristics to meet present-day requirements. The company will also be showing the new 'Adjusto-Spede' fractional horsepower packaged drive which comprises a single- or 3-phase induction motor and eddy-current coupling mounted in one combined drip-proof housing. This, with its small electronic controller, gives a very compact drive unit, it is stated.

Londex, Ltd., will be showing a complete range of automatic electrical controls of value to many industries. Principal interest will be centred on their wide range of relays, but the company's range of photo-electric equipment has also been extended to include a compact self-contained photo-transistor/counter unit capable of speeds up to 5 per sec. Among the other equipment on view will be process timing instruments, level control systems, and combined push-button indicator lamps for control panels.

Equipment displayed by **Metropolitan-Vickers Electrical Co., Ltd.**, will include a range of motors of various types, including a 60-h.p. flame-proof squirrel-cage motor. A display of switchboard and control-board pattern indicating instruments will be among the wide range of other equipment on view.

One of the features of the **Nife Batteries** stand will be a number of newly designed and self-contained equipments including their standard 30 V, 10 amp/hr tripping unit intended chiefly for switchgear operation. In addition, a 110-V switchgear-operating battery complete with control and charging equipment is being shown. Other items of interest will be typical crates of cells which are playing an important part in the British Railways modernization scheme for automatic train control and other duties. The exhibit will also include stationary batteries for traction applications.

'Davenset' automatic battery chargers employing transductors for control of current and voltages will be shown by **Partridge, Wilson & Co., Ltd.**, for stationary and traction batteries. Other 'Davenset' products on view will include transformers, and also safety devices for the supervising engineer.

The purpose of the **Rawlplug Co., Ltd.**, display will be to demonstrate how Rawlplug methods can accelerate fixing operations and bring plant and equipment into faster use. A wide range of fixing devices and masonry drilling tools will be shown.

Westinghouse Brake & Signal Co., Ltd., will have on display a comprehensive range of copper-oxide, selenium, germanium and silicon rectifiers, showing various forms of construction and means of heat dissipation.

Assembled rectifiers with associated components in differing types of housing to suit varying site requirements will also be on view.

Photographic illustrations will show some ideas of the various loads requiring larger D.C. power supplies which can now be provided by the new semi-conductor rectifiers.

In addition to these various types and forms of rectifiers will be a display of specially constructed easy to assemble 'pack-flat' metal cubicles made in many different sizes and suitable for housing all types of electrical and other components.

BOOK REVIEWS

A DICTIONARY OF CIVIL ENGINEERING. By John S. Scott. Published by Penguin Books, Ltd., Harmondsworth, Middlesex. 415 pages. Price 5s.

Those whose work brings them into contact with the civil engineering or allied industries, will find that almost every imaginable question concerning the definition of terms which is likely to confront them is answered in this book.

The book is catholic in its scope, and in addition to such subjects as railways, sewage disposal, mining and photogrammetry, embraces terms used in mechanical and electrical engineering in so far as these are applicable also in civil engineering. Where terms have a different significance in different branches of industry (e.g. creep, exciter, resistance), the varying usages are fully explained.

Building as such is not dealt with, since this will be the subject of a separate volume to be published later.

Relevant terms relating to materials handling are defined. In all cases the explanations are clear and concise and are fully cross-referenced.

A remarkable amount of information is packed into its 415 pages, and quite apart from its practical usefulness, the book is an enlightening one to browse in.

TEXTILE MACHINERY INDEX. Published by John Worrall, Ltd., Central Works, Oldham, Lancs. 682 pages. Cloth Bound. Price 42s.

The first edition of this book, compiled in collaboration with the Textile Machinery and Accessory Manufacturers' Association, was published in July 1956. The new edition now issued has been completely revised and brought up to date to cover new developments in this field.

The book comprehensively catalogues the activities of firms in the textile engineering and accessories industries and includes a classified Buyers' Guide for textile machinery, accessories and mill supplies. Textile chemicals are dealt with in a separate section which has its own Buyers' Guide.

DEVELOPMENT ANALYSIS: The Key to Enterprise and Progress and DEVELOPMENT ANALYSIS: A Rational Approach to the Valuation and Potential of Any Commercial or Industrial Enterprise. Published by C. G. Chantrill & Partners, Ltd., National House, 14 Moorgate, London, E.C.2.

These two little booklets give details of the Development Analysis services provided by C. G. Chantrill & Partners, the first being of interest chiefly to manufacturing and commercial enterprises and the second being intended chiefly for purchasers and vendors of businesses, bankers, investors and finance houses, etc.

Development analysis is based on a short-term investigation varying normally from a minimum of two weeks to a maximum of six. As defined in one of the booklets, Development Analysis investigates the performance of commercial undertakings and assesses their value in terms of financial strength, employment of labour, plant and space, etc. It indicates their potentialities for development, expansion and economies and recommends the directions in which development should be undertaken.

NEW FACTORY FOR TELEFLEX MECHANICAL HANDLING DIVISION

THE MECHANICAL HANDLING DIVISION of Teleflex Products, Ltd., has now moved from Chadwell Heath to Basildon New Town, Essex.

During the past few years the increase in demand for conveyors and other mechanical handling equipment, manufactured by the division, has caused Teleflex to seek larger premises. The new factory at Basildon occupies 50,000 sq. ft. with adequate additional land for further expansion. The division's new accommodation is adjacent to the buildings of the Remote Controls Division which has been operating there with 500 employees since 1955.

The building gives an increase of approximately 40 per cent on the old premises at Chadwell Heath. Special features of the new factory include two Matterson cranes, each with a three-ton capacity, and spanning 40 ft with a downshop run of 270 ft.

Teleflex was founded on aircraft controls 25 years ago, and since promoting the first manufacturing units in Canada and the U.S.A., has established a network of manufacturing licensees in most industrial centres of the world.

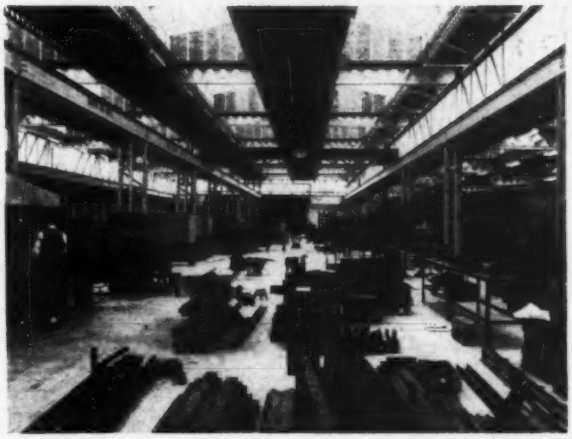
The natural growth of the company has progressed into many industries. Controls and components for all aircraft, torpedo, rescue boats and landing craft, as well as for civil vessels, are normal day-to-day production.

Following these developments new industrial fields were approached. The building industries offered immense scope for the widening of horizons and to-day window gearing, ventilation and air conditioning controls are specified for hospitals, schools, factories, steel mills and power stations, etc., in nearly every country in the world. Gearing for boilers and valves, and similar inaccessible units, have been adapted for remote control with the use of Teleflex equipment.

Thus the wider activities were absorbed and Teleflex were again exploring new industrial fields. Then, twelve years ago, the first standardized light conveyor driven by Teleflex cables was introduced. The skill and experience of the company's technicians went into the initial designs but improvements were sought constantly to increase the range of Teleflex products.

To this end the Dual-Directional chain of Keen Industrial Services, of Epping, Essex, was acquired and has now been developed into the present Teleflex Dual-Directional chain conveyor.

Some of the staff who joined the company at Chadwell Heath 20 years ago are still with the company at the new Basildon factory and many long-service records remain unbroken.



A view of a section of the new works showing one of the Matterson overhead travelling cranes

The new Basildon factory of the Mechanical Handling Division, Teleflex Products, Ltd.

NEWS OF PERSONALITIES

Harry Janssen *D. G. Haigh*
Left: B. F. Stevens

The General Electric Co., Ltd., announces the appointment of **N. W. Wood** as packaging adviser responsible for dealing with all packaging and goods handling within the company's General Products Group. Mr. Wood joined G.E.C. in 1934, and after service in the exterior lighting and electric lighting supplies departments he joined the packaging department three years ago to develop and expand the scientific side of packaging.

M. Clayton, joint managing director of British Ropeway Engineering Co., Ltd.—leading makers of ropeways and cableways—left England on February 12th on the *United States* for a business promotion tour of the industrial centres of North America.

He will be visiting New York, Chicago, Pittsburgh, Denver, San Francisco, Mexico, New Orleans and Washington, and returning from New York on March 25th on the *Queen Mary*.

D. D. Morrell, managing director of The Mitchell Construction Co., Ltd., has been appointed a director of Mitchell Engineering, Ltd.

D. G. Haigh, M.I.E.E., has been appointed export manager of Chloride Batteries, Ltd. He is now responsible for ensuring co-ordination of export marketing, within the existing framework of the product selling organization, for the control of overseas representatives and the overall administration of overseas agencies.

Lancashire Dynamo announce the appointment of **R. A. Bent, A.M.I.E.E., A.M.Brit.I.R.E.**, to the Board of Lancashire Dynamo Holdings, Ltd.

Harry J. Janssen has been appointed chief engineer of Hyster N.V., Nijmegen, The Netherlands, according to an announcement by Harvey Raasch, managing director.

About to leave this country for a visit to the United States and Canada is **L. Rumley**, sales Director of Conveyancer Fork Trucks, Ltd. and Electro-Hydraulics, Ltd., Warrington (two members of the Owen Organization).

Mr. Rumley's tour will include a visit to the Canadian Materials Handling Exposition, a visit will also be made to Conveyancer's Canadian Plant in Toronto, and also some of the major users en route.

R. A. Lister & Co., Ltd., the West of England engineering company, announce that **P. Mackay-James**, the director and general manager of their subsidiary company Blackstone & Co., Ltd., and **F. E. Blackstone**, a director of Blackstone & Co., Ltd. and other subsidiary companies, have been appointed to the Board of R. A. Lister & Co., Ltd.

Chamberlain Plant, Ltd., a member of the Chamberlain Group and with offices and works at Crown Works, Southbury Road, Enfield, Middlesex, reports that it is

L. Rumley *N. W. Wood*

opening up a branch depot at Milford Haven to handle the increasing contractors' plant hire side of the business developing in that area.

The Milford Haven depot will be under the control of **B. F. Stevens**, who has been with the company for 20 years and who will be available to advise on any hire project in the West Wales area.

OBITUARIES

The death is reported of **Dr. J. B. Mavor** who, until his retirement three years ago, was Chairman of Mavor & Coulson. Dr. Mavor was born in 1889 and after a sound apprenticeship in engineering, he joined the company in 1910. He became a director in 1920. He was a M.I.Mech.E., M.I.E.E. and LL.D. of Glasgow University.

Dr. J. B. Mavor *T. A. Hammersley*

We regret to report the death of **T. A. Hammersley**, joint managing director of Marco Conveyor & Engineering Co., Ltd., who died after a long illness. Mr. Hammersley was 64 and had been with his company for over 30 years. Mr. Hammersley, or Tom, as he was known to most of his friends, was elected to the executive committee of the Mechanical Handling Engineers Association in 1951 and remained in office up until the time of his death.

He was appointed a member of the M.H.E.A. technical committee in June, 1943, and its chairman in 1948, which office he held until his passing. He was one of the original members of the M.H.E.A. film sub-committee, which was created in January, 1947 and on which he served until the end of December, 1957. Mr. Hammersley was closely associated with the work of the Fédération Européenne de la Manutention and he was elected chairman of Section 2 (Continuous Conveying) in October, 1957. This position he had to give up in October, 1958, as the result of his continued poor health.

We regret to report the death of **William Henry Atherton** at the age of 91. Mr. Atherton was one of the oldest living persons in the field of mechanical handling. At one time he was a Director of Ley's Foundry and Engineering of Derby. He was the author of several books on the subject of mechanical handling and for some time was a frequent contributor to this journal.

REVIEW OF NEW EQUIPMENT

DE-ICING ROAD GRITTER

To enable standard tipping vehicles to be utilized for road gritting operations during icing weather conditions, thus avoiding the cost of acquiring for this purpose special machines that may well lie idle for many months of the year, A.C.E. Machinery, Ltd., Porden Road, Brixton, London, S.W.2, have produced a new self-contained gritting attachment that can be quickly installed in tipping lorries. With a standard cowling, it will spread a thick carpet of up to 18 ft in width.

An A.C.E. de-icing road gritter attachment in the operative position on an end-tipping lorry

From a triangular-shaped hopper mounted on the floor of the vehicle body held in a tipped position, the grit is fed by gravity to twin-plate spinners carried behind at a low level. A 1-h.p. Villiers air-cooled petrol engine drives the spinners at a speed of up to 700 r.p.m. through a chain and bevel gearbox. The engine speed, which governs a centrifugal clutch, is remotely controlled from within the driver's cabin, so that spreading operations can be applied as required whether the machine is travelling or stationary. A hand-operated gate control can be set to provide a fine or heavy spread, and a stout metal cowling prevents grit being thrown out above spinner height.

MICHIGAN PIPEHANDLER

Michigan (Great Britain), Ltd., of 3, 4 & 5 Charles II Street, St. James's Square, London, S.W.1, are offering a machine designed to overcome problems met with in handling tubulars in oil fields from the stockyard to the well site. Present methods vary according to local conditions, but usually call for a diversity of equipment and manpower, resulting in considerable idle time, and heavy wages and maintenance charges.

The Michigan method is to use one machine for stacking, loading, conveying, off-loading and placing in position. The Pipehandler is not merely an efficient loader; it is designed to draw a trailer conveying pipe from yard to site. Its large-capacity diesel engine, torque converter, four-wheel drive and high flotation tyres give exceptional 'off road' characteristics, so that it may easily negotiate the rough terrain surrounding drill sites.

The Michigan Pipehandler has a lifting capacity of 20,000 lb and travel speeds up to 25 miles an hour. Hydraulic power controls and a specially designed clamp allow finger-tip precision in off-loading so that casing and drill pipe are delivered undamaged and line pipe may be placed accurately into position. Individual lengths of pipe are under the positive control of the operator.

Thus the whole operation from stockyard to point of use is carried out by one machine and one man; urgent calls can be met speedily without having to organize special transport and labour. In comparison with the existing diverse methods these advantages alone will show considerable savings. The Pipehandler, however, is a versatile machine and may be fitted with a number of alternative end attachments, such as shovels, back filler blade, crane hook attachment, etc., which make it also a general-purpose tool always able to earn its keep.

Our photograph shows the machine in use by the Shell Petroleum Co., Ltd., in Venezuela.

Michigan Pipehandler places tubes on to trailer direct from stack

The 'Byric' auger elevator is seen here feeding a silo. Output at 45 deg is 10 tons of wheat per hour

AUGER ELEVATOR

Though intended primarily for agricultural duties, the 'Byric' auger elevator is likely to prove of value for many industrial purposes as well.

The elevator is made in three standard sizes: 11 ft, 16 ft, and 21 ft respectively. All three models are light in weight, enabling them to be carried and positioned by one man.

A special feature of the galvanized elevator tube is its weldless construction, which affords an unimpeded flow of material. One-piece flight construction is also employed.

The tested output is 10 tons wheat/hr at 45 deg, but a throttle control enables this to be reduced to any desired rate of feed. Details of the vertical lifts obtainable from ground to point of discharge, at various angles of inclination, are as follows:

Model	40 deg	50 deg	60 deg	70 deg
ft	ft in	ft in	ft in	ft in
11	6 6	7 9	8 9	9 6
16	9 8	11 7	13 1	14 2
21	12 11	15 5	17 5	18 11

The machine can be powered by either petrol engine or electric motor, as desired.

Manufacturers are Byron Farm Machinery, Ltd., Byron Works, Blackhorse Lane, London, E.17.

HYDRAULIC LIFT TRUCK TABLE

First introduced into this country at the recent commercial and international motor shows, the Nike Type LV 750 hydraulic lift truck table, manufactured by the Swedish Domkraft AB Nike, is handled by the sole concessionaires, Lawrence Edwards and Co. (engineers), Ltd., Commercial Buildings, Oxford Street, Kidderminster. It saves time and space when employed for lifting and transporting workshop equipment and facilitates material handling when used as a collecting table. It is fitted with two fixed and two swivelling castors and a hinged towing and pumping handle. By means of the pump handle the height of the table can be easily adjusted as required and lowering is governed by an easily accessible valve by which the lowering speed can also be regulated.

The lifting capacity of the table is 1,653 lb, the total weight 243 lb and the approximate table dimensions are: minimum height from floor, 5 in, maximum height 33 in, length 32 in and width 18 in.

The Nike LV 750 hydraulic lift truck with table in the raised position

CONVERTIBLE SALVAGE CRANE

Within its capacity range, most salvaging requirements should be met by the new HF convertible salvage crane with variable jib controlled by a luffing screw, having safety pins for altering the jib height. With jib horizontal the hook overhang is 4 ft for a lift of 3 tons. Conversion for a maximum lift of 30 cwt with 8-ft hook overhang is obtained by withdrawing one drop-nosed pin to release the 3-ton snatch block, when the cable can then be also run out for winching. The luffing screw is provided with safety pins for altering height of jib. With the jib at maximum height the hook overhang for lifting 3 tons is 3 ft 6 in and for 30 cwt 6 ft 6 in. The maximum height of hook for a 3-ton lift with the crane mounted on the floor of a vehicle 3 ft 6 in from ground level is 7 ft and for 30 cwt, 9 ft. Features include two handles for two-man operation

The HF convertible salvage crane, with lifting capacity of 3 tons or 30 cwt according to the jib overhang

if required, adjustable handles for minimum or maximum loads, brake with enclosed ratchets for safe lowering, though without affecting lifting when fully applied and swivelling sheaves for side lifts. The crane is tested for 25 per cent overload.

NEW PORTABLE BELT CONVEYOR

Rowland Priest, Ltd., of Cradley Heath, Staffs., have been appointed sole British distributors of the well-known Escher range of portable conveyors. Capacities of up to 50 tons/hr with a belt speed of 220 ft/min are obtainable.

The normal belt, which has a vulcanized joint, is of black rubber with three solid-woven inlays. It is suitable for use as a troughed belt or a flat belt, according to the type of supporting idlers fitted.

The conveyors are powered by a drum motor in which the whole of the driving gear is enclosed within the drum itself. The conveyors are equipped at the discharge end with a self-adjusting scraper for removing wet, sticky or dry materials that fail to discharge from the belt.

The removable V-type undercarriage is constructed of extra-heavy steel tubes and is capable of vertical adjustment by means of a hand-operated winch of the self-locking worm type. This winch will afford infinite variation between the minimum and maximum heights of discharge.

A number of optional features and accessories are available, including cleated or grip-surface belts, canvas or cotton

The Swedish BT hydraulic pallet lift truck now available in this country

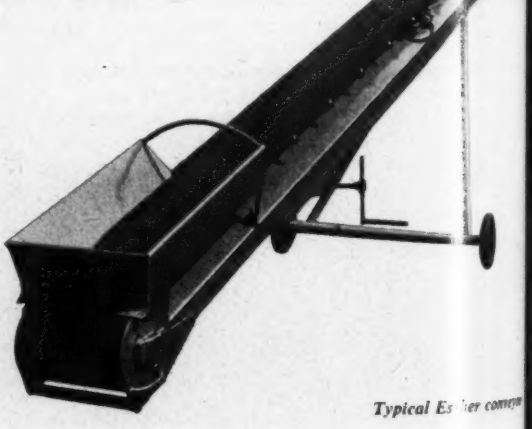
belts, feeder hoppers, etc. Special attention has been given in the design of the machine to securing a long and trouble-free service with a minimum of maintenance.

PALLET LIFT TRUCK

Now available for the first time in this country, the Swedish BT pallet lift truck incorporates several new features for this type of equipment. With forks raised hydraulically by hand operation, it is supplied with a capacity of 2,400 or 4,400 lb and in widths ranging from 20¼ in to 27 in. The forks are one-piece stampings, available in standard lengths of 36 in, 42 in and 48 in. Non-standard widths and lengths can be provided at a small additional charge. The forks can be raised from 3¼ in to 8 in above ground level by a few strokes of the steering handle.

The hydraulic unit is entirely leakproof, even if turned completely over, and special plastics packing with extra-hard-wearing characteristics is used for the pump. The 8-in dia steel steer wheels and 3½-in fork rollers are mounted on fully enclosed SKF ball bearings and are available with hard rubber treads. Alternatively, wheels and rollers of

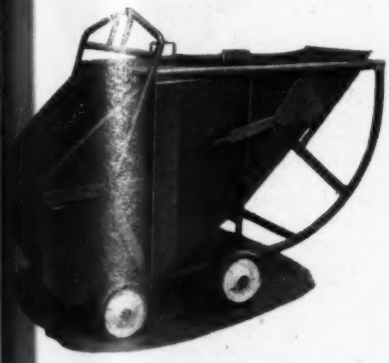
(*continued on page 177*)



Typical Escher conveyor

nylon-reinforced Bakelite provide hard-wearing qualities with low rolling resistance, reducing operator fatigue when heavy loads are handled; unlike the wholly nylon type, these can be employed without restriction on surfaces contaminated with grease, oil and most chemicals. The wheels can be pivoted through an arc of over 180 deg which, with the SKF bearings, allows exceptional ease of manœuvrability in confined spaces. Spare parts and serving facilities include the provision of factory-reconditioned hydraulic pump units, which are readily interchangeable.

The sole distributors in this country are Rolatruck, Ltd., 20 Old Compton Street, London, W.1.



Quicker handling under a concrete mixer is made possible by this new Abelson rollover-type pram skip

ROLLOVER PRAM SKIP

To cut down the time required in placing and removing concrete skips under a concrete mixer, Abelson & Co. (Engineers), Ltd., Coventry Road, Sheldon, Birmingham, 26, have now produced a four-wheeled layback or rollover type of skip which can, even when fully loaded, be comfortably handled by one man. It is built basically upon the Abelson ½ cu. yd. non-choke layback concreting skip. The pressed steel bonded-on rubber wheels are each capable of accepting a load of 750 lb and the total weight of the skip is about 5¼ cwt.

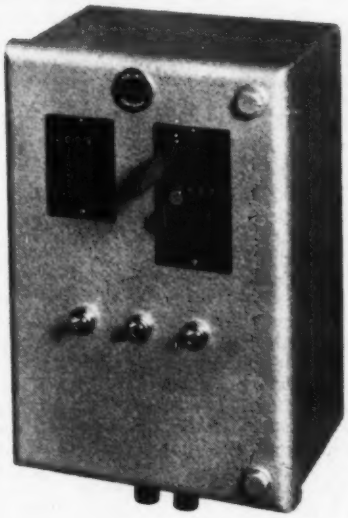
Quicker handling is achieved by utilizing two skips in a pouring cycle, placing them one behind the other at the mixer so that as a loaded skip is taken away by the crane, the second one waiting behind it is wheeled into place ready for filling. The first skip, when empty, is then dropped in place behind that being charged and left to be pushed into place as the filled skip is removed by the crane. The two skips then alternate for as long as pouring is required to continue so that no time is wasted by the crane in waiting for a skip to be charged.

TIMER-COUNTER UNIT

Lindars Automation, Ltd., a subsidiary of Dunford and Elliott (Sheffield), Ltd., Attercliffe Wharf Works, Sheffield, 9, have recently developed a small and compact combined events per unit time and time per unit event counter. Its uses include accurate measurement of shaft speed, process timer checking, ascertaining rate of package flow, vehicle rate checking and similar purposes.

Basically the unit consists of an electrical preset counter, an electrical resetting counter and a 1 rev/sec synchronous motor, giving 10 impulses per revolution. The required time may be set on the presetting counter up to a maximum of 999·9 sec and, on expiration, the number of events will be displayed on the resetting counter. Alternatively, should it be required to time a number of events, the number may be pre-set and, when completed, the elapsed time is displayed to $\frac{1}{10}$th of a second. It is necessary for the events to be in the form of impulses received from, say, a micro-switch, photocell, etc., and may be up to a maximum of 10 per sec. To ensure accuracy, first-pulse suppression is incorporated, the first pulse starting the timing but not registering on the counter. The obvious advantage over the more conventional stop-watch method is that the count remains indicated and human error is entirely eliminated.

BELOW
The Lindars timer-counter unit



ALL-PURPOSE HAND TRUCK

Of particular interest to the chemical, oil, food, printing ink and most engineering industries, for the movement of barrels, drums, casks and all kinds of shaped objects, the new Quinell all-purpose hand truck can carry loads up to 6 cwt with absolute safety and can be loaded and pushed with ease. Of robust construction, the truck is carried on two solid acid-resisting rubber wheels with hardened ground bushes. The overall length is 4 ft 6 in, height 2 ft 3 in and the cradle dimensions are 24 × 18 × 4 in deep. The total weight is 44 lb. The front edge of the cradle is tapered to allow easy entry under the object to be lifted, while a grappling hook on the handle shaft can be adjusted up and down its entire length to secure the load to the cradle. No maintenance is required other than occasional greasing of the wheel spindles.

The truck is manufactured and distributed by Cranmer Engineering, Ltd., 45 New Cross Road, London, S.E.4.

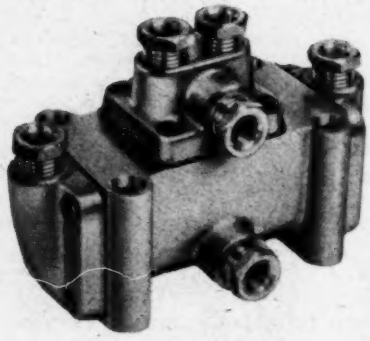
The Quinell all-purpose hand truck

OIL-HYDRAULIC CHECK VALVES

Developed primarily for high-pressure oil-hydraulic applications, but also suitable for other oil systems, such as lubrication installations, a new range of check valves is announced by the Hydraulic Components Co., 5 Manor Gardens, Scarborough. There are two models. One is for use as a check valve to prevent reversal of the direction of flow in hydraulic circuits and lubrication oil installations. Applications include machine tool, mechanical handling, earth-moving, mining, marine, mobile and general industrial fields. The other, to restrict the return flow, has a by-pass orifice drilled to suit individual requirements in a case-hardened alloy steel disc, precision-ground concentrically on seat face and guiding diameter for accurate seating and long life. Examples of application are spring-applied, hydraulically released brakes on winches which must be quick-acting yet released gradually to permit fine control and inching, and weight-lifting where it is required to lift freely and lower at a restricted rate.

A ¾-in B.S.P. example of the new range of oil-hydraulic check valves introduced by the Hydraulic Components Co.

Having externally threaded connections, the valves can be screwed direct into other units at either end, eliminating intermediate pipes, fittings and supports. The valve-ends suit standard tube fittings for pipe lines, the overall length is less than that of valves with internal thread connections and the valve inlet is machined to internal cone to fit direct to standard hose fittings without adaptors. Of simple construction, compact and light in weight, these valves cannot leak. They are of wrought steel, ensuring freedom from porosity, foundry sand and scale, uniform wall thickness and shock resistant. External parts are cadmium-plated to prevent corrosion. Materials conform to British standards and each valve is individually tested.



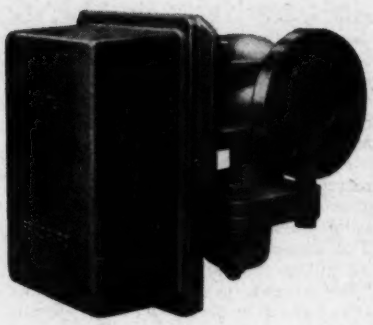
A Lang Type A2501 double air-operated four-way automatic control valve with full ¼-in ports

AUTOMATIC CONTROL VALVES

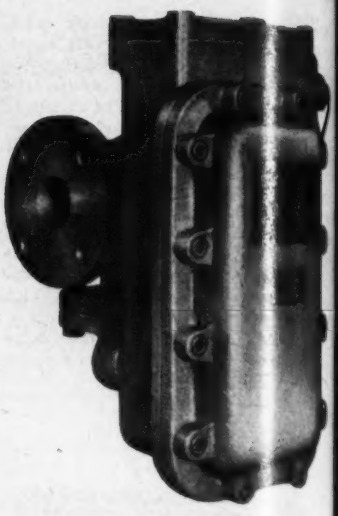
A new range of totally enclosed four-way automatic control valves of the double air-operated, air-operated self-reversing, double solenoid-operated, solenoid-operated self-reversing and single solenoid-single air-operated types has been developed by Lang Pneumatic, Ltd., Victory Works, Birmingham Road, Wolverhampton. They are of the linear slide valve type, based on the A2501 example illustrated, having the operating shuttle and valve slide made from stainless steel, all internal parts of non-ferrous metals and the body from hot brass stampings. To allow maximum sensitivity, 1¼-in dia piston cups have been used and under test the following figures have been obtained: With 80 lb/sq. in. in the valve chamber the pressure required to operate the pistons is 15 lb/sq. in. The lowest equal pressure recommended is 10 lb/sq. in. A side entry block is available for all valves if required in place of the standard top port block shown in the illustration. Setting handles can be provided as an extra.

SEMI-BALANCED SOLENOID-OPERATED VALVES

A range of heavy-duty solenoid-operated globe pattern valves of the semi-balanced type is available from Jones Tate & Co., Ltd., Victory Works, East Parade, Bradford. These valves, known as the series 319, are designed specifically for the control of fluids, including gases, in industrial processes.



ABOVE
Dust-proof pattern semi-balanced solenoid-operated valve (Jones Tate & Co., Ltd.)



RIGHT
This picture shows a Jones Tate flameproof pattern valve in their series 319 range of solenoid valves

The standard range of valves is made in sizes from ⅛-in to 4-in bore, suitable for pressures ranging from vacuum to 200 lb/sq. in. maximum.

Special valves are also available for operation at higher working pressures up to 2,000 lb/sq. in., or elevated temperatures including superheated steam.

All valves can be fitted with supplementary manual operation means and/or interlock switches.

FAST-LIFTING FORK TRUCKS

The Yale Series 51 electric fork trucks in capacities from 3,000 lb to 10,000 lb can now be obtained with a laden lifting speed, for loads of up to 2 tons, of 40 ft/min and unladen speed of over 60 ft/min. This speed, said to be the fastest of any British-built fork truck of equivalent capacity, should be of particular interest to firms whose handling involves frequent high stacking. Standard heights of lift are 100 in, 130 in and 144 in. Normal attachments can be operated. In the conventional speed range Series 51 trucks can be obtained with a stacking height of 30 ft for loads of up to 4,000 lb.

MULTI-MOVEMENT LIFT

With the Dumbo auto-turning load lift—the latest addition to the Mackaness range of loaders—sacks, barrels, open containers and unit loads of all kinds can not only be raised or lowered any distance within its range, but be automatically swung safely into the receiving area. The lifting platform rises as soon as a load is placed on it, automatically stops at any required height and turns laterally through 180 deg or less to suit individual applications. Thus the load can be offered at a receiving bay at any floor level or taken on to another floor, being swung clear of any ramps protruding from intermediate receiving bays, but returned to well within the floor area of unloading and loading points. It can continue this operation from floor to floor.

The Dumbo undercarriage is mounted on four rubber-tyred wheels, the front wheels interconnected and of the self-steering type. Raising, lowering, lateral rotation and, where required, inversion of the lifting platform are fully automatic.

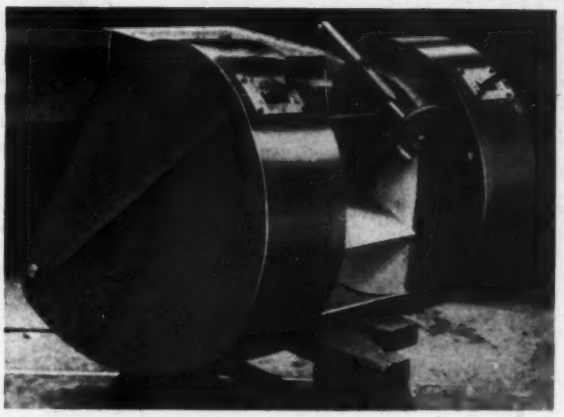
(*continued on page* 179)

A fixed Dumbo lift feeding four floors to a height of 50 ft

powered by a fully enclosed electric motor with worm-reduction gearbox and cable-winding drum. It can be made in any height or size and is admirably designed in its Minor, Junior and Senior sizes as a mobile vehicle-loader. The lifting capacity of these is 2 cwt, and it is claimed that with a Dumbo two men can load 400 sacks an hour. The Minor will lift sacks to shoulder height, the Junior, ideal for coal sacks, to 6 ft 6 in, and the Senior to 8 ft 6 in. Another mobile version, the 'Super', is designed to lift up to 21 ft, being able to swing round clear of the roof of pantechnicons or other vehicles before continuing its upward journey.

Apart from the mobile versions, the Dumbo, with lifts up to 50 ft, can be permanently fixed outside a building or installed indoors where it can pass through apertures in each floor. For discharging into hoppers it can be made to invert itself after having swung automatically over the hopper, the container being secured to the platform.

Manufacturers are the Service Engineering Co. (Northampton), Ltd., Weedon Road, Northampton.



The new Parker Blender volumetric feeder for asphalt and tarmacadam plants

A Gibbins general-purpose jack

REPLACEMENT SERVICE FOR JACKS

To eliminate inconvenience and delay while jacks are repaired a new replacement service has been introduced by Richard C. Gibbins & Co., Ltd., Berkeley Street, Birmingham, whereby damaged Gibbins G.P. jacks are immediately replaced from stock with reconditioned jacks, fully tested and certified. Only the cost of repairing the jack returned by the user is charged.

Introduced in May, 1954, these jacks, of 10 and 15 tons capacity, have automatic up and down action to lift a full load on the head or toe, maximum lifts of 11 in and 12 in respectively, a solid fulcrum, integral with the socket and with large bearing surface, and a ribbed arched base to give maximum gripping power.

In addition to bottle jacks for general engineering requirements, the Gibbins range includes jacks for cable drums, pole jacks, with ratchet lift action, and electric jacks, designed for use in pairs or fours for lifting railway carriages where overhead lifting is not possible.

BATCHING PLANT BLENDER

For reconstituting aggregates and supplying accurately proportioned batches to asphalt and tarmacadam plants, the Parker Blender, now being marketed by Frederick Parker, Ltd., Viaduct Works, Catherine Street, Leicester, can be used singly or grouped in any number to give continuous feed or intermittent batches of blended aggregates. It uses the natural fall of the material through an adjustable gate together with rotating paddles for discharging from storage bins. The total rate of delivery can be designed to suit requirements, but average installations deliver to vehicles 2½ to 3 tons a minute. The proportions of aggregate can be varied by resetting the blender by hand or remote control, and with the simple paddle speed and door adjustment all units discharge for the same period of time to give their proportions to the mixture. Drive for the blender can be by one motor and coupling shafts or by a motor for each feeder. Where frequent proportion changes are to be made, the feeders can be fitted with four-speed drive, and a chart shows the positions to which speed change levers and discharge doors should be moved to give the required specification. A neutral speed change lever position cuts out any feeder not needed. Three sizes, 12 in, 18 in and 24 in, are available.

APRIL

The above issue will contain, amongst others, the following articles:—

Package Handling—Part II

The Automatic Facing of Letter Mail

and usual features

TRADE NOTES

Dimensions of Ball Bearings and Parallel-Roller Bearings (B.S. 292: 1958)

This revised publication (65 pages, 56 illustrations) relates to those features which control the interchangeability of bearings as units; it does not deal with their internal dimensions or detailed design.

Dimensions are specified for single-row, angular contact and double-row journal bearings; for rigid, parallel-roller, journal bearings; for snap-ring-type ball-journal bearings; for magneto bearings, and for single-thrust bearings with flat seatings and with spherical seating rings.

Inch and metric sizes are provided up to 30-in and 400-mm bore respectively, though not as equivalents. The tolerances on the external dimensions, diametral clearance, and permissible errors due to wobble and eccentricity are specified, as are fillets and shoulder heights for metric journal bearings.

A standard nomenclature for the component parts of bearings is included, with the British Standard reference symbols for each type and size of bearing.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1. Price 12s. 6d. (Postage will be charged extra to non-subscribers.)

Mechandling, Ltd.

This company has moved to 52 King William Street, London Bridge, London, E.C.4. The telephone number remains unchanged (Mansion House 8277-8279).

Non-Destructive Testing

R. F. Fraser-Smith of 69 King's Cross Road, London W.C.1 (telephone, Terminus 1064/5) announce that they are able to supply non-destructive testing equipment and accessories; in particular they are manufacturers of Gamma-ray equipment of a new design.

Dexion to be made in New Zealand

New Zealand will this month become the 14th overseas country to manufacture Dexion slotted angle.

C. W. F. Hamilton & Co., Ltd., of Middleton, Christchurch, will be able to produce up to 2,000,000 ft of Dexion a year.

C. W. F. Hamilton are manufacturers of agricultural and earth-moving machinery.

Most of the machinery for making Dexion and Dexion cutters has been made from drawings sent by Dexion in London, and John Broadhead, Dexion's chief engineer in Australia, has gone to Middleton to complete the installation.

Dexion was invented by Demetrius Comino in 1947. From a three-man factory in an overgrown garage, it has grown into a world-wide organization.

Joy-Sullivan appoint 'Limberoller' Distributors in U.K.

Since their introduction to Great Britain four years ago 'Limberoller' conveyor idlers have become increasingly popular in a wide range of industries. So far, the distribution of the idlers has been handled by Joy-Sullivan, Ltd., who manufacture the 'Limberollers' at their Cappielow factory, Greenock, Scotland.

Because of the interest in the idlers by industries other than mining and quarrying with which Joy-Sullivan are mainly concerned the company has decided to appoint distributors in Great Britain to handle the sales and servicing of 'Limberollers'. The distributors will also hold comprehensive stocks of the idlers and members of their staff will be trained on installation.

The distributors appointed so far are: *Scotland:* Potter Cowan & Co., Ltd.., 54 French Street, Glasgow, S.E.2; *North Eastern England:* Glover & Wood, Ltd., Victoria Works, Victoria Road, Leeds 11; *North West:* Rolkin Shakeshaft, Ltd., Atlantic Street, Broadheath, Altrincham, Cheshire; *Midlands:* Central Manufacturing & Trading Co. (Dudley), Ltd., Halesowen Road, Old Hill, Staffs; *South West:* Compressed Air Services (Bristol), Ltd., Warleigh House, Earle Road, Bristol 4; *South East:* Southern Industrial Rubber, Ltd., 1 High Street, South Norwood, London, S.E.25. A distributor for Northern England, probably based in Newcastle upon Tyne will be appointed shortly.

British Kestrel Side-operating Fork lift carrier

We should point out that with our December issue, we published an edition of our 'At-a-Glance' list of British-made fork lift trucks. It will be appreciated that this went to press long before the contents of our December issue were printed and, whilst this list was being printed, the British Kestrel side-operating fork lift carrier came into production. Our list does not include details of this carrier but it will, of course, be included in the next reprint. We are asked to make this announcement by Materials Handling Equipment (Great Britain), Ltd.

W. H. Dorman acquire W. G. Bagnall

W. H. Dorman & Co., Ltd., Engineers, Stafford, have completed negotiations for the acquisition of the whole of the share capital and undertaking of W. G. Bagnall, Ltd., Engineers, Stafford, from The Heenan Group, Ltd., Worcester.

Forthcoming Management Courses

Urwick, Orr & Partners, Ltd., 29 Hertford Street, Park Lane, London, W.1, the management consultants, announce that the following of their regular courses will be held this spring in their two training centres in Slough and Bedford.

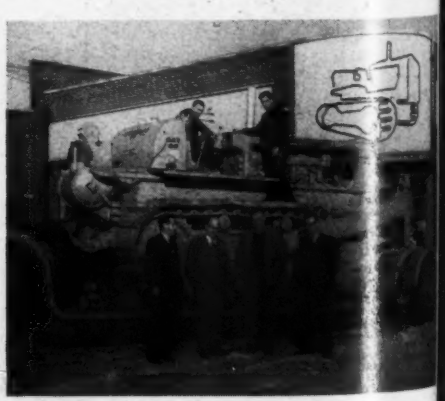
Starting May 1959

May 19th—*Work Study and Management* (*Building*): for executives in the building industry who will be heading

(*continued on page* 181)

This Ameise 65 fork lift truck, made by Jungheinrich, of Hamburg, is fitted with a 3-cylinder Perkins P3/144 diesel engine with a Brockhouse torque converter. It has a lifting capacity of 3,000 lb and a lift of approximately 11 ft. Ameise trucks are distributed in this country by Jewsbury's Mechanical Handling, Ltd., Chapel St., Manchester, 3

The first of the new Caterpillar British-built D8 crawler tractors supplied by Leverton of Leeds, Ltd., has now been delivered to a civil engineering site in Leeds. The machine is shown here being handed over by Mr. J. G. Smith (left) a director of Leverton of Leeds, Ltd., to Mr. Eric Raynor (right centre) of Raynor Contracting Co., Ltd. Also shown in the photograph are Mr. F. Parnham, service director, Mr. M. R. E. Chapman, sales manager, and Mr. A. Coulson, service supervisor, Leverton of Leeds, Ltd.



10 ton of grain up to the third floor in 14 min! This T. & T. super-duty sack elevator feeds well into the building at any point on any floor, being adjustable for height and readily traversed sideways as required; it was specially built for Messrs. C. B. Lowe (1920), Ltd., Sheepy Mills, Nr. Atherstone. Manufacturers were T. & T. Works, Ltd., Billesdon, Leicester

Steel sheet in 30-cwt packs is off-loaded and stored by 'Worksaver' at the works of T. Marshlain & Co., Ltd.

productivity and work study departments or be collaborating closely with productivity and work study officers. Slough, residential, six weeks. Fee 200 guineas not including residence.

May 19th—*Work Study (General):* for potential work study officers in any industry. Bedford, residential, eight weeks. Fee 150 guineas not including residence.

Starting June 1959

June 8th—*General Management:* for middle and senior managers. Slough, residential, eight weeks. Fee 275 guineas not including residence.

'Stelvetite' Exhibition

An exhibition devoted entirely to the fabrication and applications of Stelvetite, Britain's new plastic-coated steel sheet was staged at the Royal Festival Hall, London, recently by the manufacturers, John Summers & Sons, Ltd., of Shotton, Chester.

The exhibition was arranged in order to demonstrate exactly what can be done with Stelvetite.

A series of demonstrations included spot welding (which can be done without damage to the P.V.C. coating), high-frequency welding, lock forming, printing and drum sealing.

Stelvetite in all its available colours and gauges was shown with a large selection of the things now being produced in the material such as office furniture and machines, chemical equipment, refrigerators, domestic water-heaters and clocks.

Permanent Exhibition of Electrical Equipment in Norwich

Laurence Scott & Electromotors, Ltd., manufacture special electric motors and control gear which finds its way into a variety of industries. Of importance is that the equipment be shown conveniently under working conditions. Part of the works of the company in Norwich has now been set aside for these working exhibits, the equipment being divided mainly into two classes, namely variable-speed drives and electrical equipment used to drive auxiliaries in ships. Among the variable-speed machines are examples of the N-S variable-speed A.C. motor with different forms of hand and automatic speed control; squirrel-cage motors controlled on variable-frequency circuits; the Revcon system for slip-ring motors in crane hoists as well as the Ward-Leonard control of D.C. motors.

Likewise, the marine equipment is arranged to represent a small ship's engine-room with a high-performance alternator supplying large switching currents with minimum voltage disturbance, the Trislot high-torque low-current squirrel-cage motors coupled to pumps, etc., with provision for measuring the performance of the alternator and the motors under practical conditions. Other exhibits include working models of the Selector cargo winch and the Pitt-Scott constant-tension mooring and towing winch.

A small cinema is available leading from the exhibition hall where films describe the principle of operation of many special machines manufactured by the company.

The opening of the exhibition coincides with the 75th anniversary of the formation of the company in Norwich by W. H. Scott.

Savings by Fork Lift Truck

Evidence of the savings in time, money and effort attributable to the use of a single Yale Worksaver fork lift truck is provided by the experience of T. Marshlain & Co., Ltd., a small Leicestershire firm of sheet metal workers in meeting the call for shorter working hours without loss of pay, yet increasing production. As production increased, more and more costly man-hours were absorbed in unloading raw materials, moving work in progress and despatching finished products. As output, earnings and profits were affected by this growing handling problem, a careful study was made of handling operations throughout the factory, and as a result of a demonstration given by the Yale & Towne Manufacturing Co., Wednesfield, Wolverhampton, a Worksaver truck was purchased.

To-day, this machine unloads and stores raw materials, slashing seven man-hours off this operation alone. It does all the handling of products from one process to the next and loads the finished products on to lorries for transport. It has increased the firm's output by 12 per cent, has saved time, allowed new products to be manufactured and has more than paid for itself in actual savings in less than a year.

'New Bulk Container with Blower Discharge'

In the above report, published in our November issue, page 734, we used the word 'airslide'. We have been asked to point out that 'Airslide' is the trade name of the Fuller Company of Catasauqua, Pa., U.S.A., and the sole registered proprietors in this country are Constantin (Engineers), Ltd.

Italian Agents for Keelavite Hydraulics

Keelavite Hydraulics, Ltd., of Allesley, Coventry, have appointed Elettro Tecnica Apparecchiature (ETA) as their agents in Italy, for the sale of hydraulic installations and units.

ETA, who were formed in 1949, are able to offer a technical consulting service on hydraulics. Their head office is at Piazza Guastalla 15, Milan, with branches and agents covering the whole of Italy.

New Conveyor Contract for Chile

The New Conveyor Co., Ltd., of Brook Street, Smethwick, Birmingham 40,

The new Fourways slat conveyor, operating at an angle of 40 deg, at the works of the Watford Steam Laundry, Ltd. This installation is briefly described below

announce that they have recently obtained an order in New York for an ore-handling plant to be erected in Chile. This order was obtained in the face of American competition, and is the second plant order they have obtained in South America in the last six months. Further developments in this area are expected shortly.

Tractors for South Africa

Over 30 Michigan tractor shovels were shipped to South Africa recently. Amongst these was the first consignment of a fleet of Michigan models 85A for the Water Affairs Department, South Africa. These British-built machines are in demand all over the world and it is significant that Michigan can now supply from British production large-capacity wheeled tractors which 12 months ago could only be met from American sources.

The 85A tractor shovel, fitted with bucket teeth, is a digging and loading tool. This model has been introduced to provide extra power and capacity—it can lift 9,000 lb and is fitted with a heavy-duty bucket of 1¾ cu. yd. Buckets up to 5 cu. yd. are available for light materials handling and additional accessories include back-filler blade, fork lift, crane hook, root rake and scarifier.

This machine is designed to operate over rough terrain and has travel speeds up to 26 m.p.h. Manufacturers are Michigan (Great Britain), Ltd., 3, 4 and 5 Charles II Street, London, S.W.1.

Sheepbridge Engineering, Ltd.

Sheepbridge Engineering, Ltd., Chesterfield, Derbyshire, announce certain important changes in the structure of two of their subsidiary companies.

Mr. R. W. T. Bray has severed his connection with Bray Construction Equipment, Ltd., Faggs Road, Feltham, Middlesex, manufacturers of the well-known range of Bray Hydraulic Loading Shovels and earth-moving equipment. Mr. D. J. Harrowell, formerly Technical Director, takes over as Managing Director. Mr. W. J. Collard, who was transferred from Bray Construction some years ago to an appointment as Director and General Manager of Harold Andrews Sheepbridge, Ltd., now returns to Feltham as Commercial Director.

Mr. Collard's duties as General Manager at Harold Andrews Sheepbridge, Ltd., of Halesowen, Birmingham, who produce cylinder liners for the automobile industry, and also continuously cast iron bar, are being taken over by Mr. B. C. Goodwin, formerly Sales Manager with the same firm.

High-Angle Conveyor Aids Laundry Handling

An inclined slat conveyor handles 30 ton of dry laundry a week from transport room to sorting room at the Watford Steam Laundry, Ltd.

The electrically driven conveyor unit, supplied by Fourways (Engineers), Ltd., of Epping, Essex, has an elevation of 40 deg. The track is reversible and travels at a speed of 50 ft/min. Loaded baskets and cardboard containers of various sizes and weights are fed automatically from the conveyor on to a gravity roller section and are manually discharged at appropriate points along the length of the roller conveyor for unpacking and sorting of the soiled linen.

Talk on Lifting Tackle

Mr. Bernard Buckley, Sales Manager of Felco Hoists, Ltd., and a Director of Felco (Crawley), Ltd., gave an interesting talk recently to the Council Members of the Association of Engineering Distributors. Mr. Buckley described the varied range of lifting appliances manufactured by his company and dealt with the relationship between manufacturer and distributor. Some very lively and interesting questions followed the talk.

'Matbro' organization

It is announced by H. & L. Mathew, Ltd., that the companies within the 'Matbro' organization will now be known as the 'Matbro Group of Companies'. The Companies included in this group are as follows:—

Mathew Brothers, Matbro Works, Sandy Lane North, Wallington, Surrey: Manufacturers of the 'Mastiff' and 'Super Loadstar' range of loading shovels, 'Mantis' excavator, and the 'Matbro' series of fork lift trucks.

Mathew Brothers, Matbro House, Beddington Lane, Croydon, Surrey: Machinery merchants.

Power Plant Hire (Beddington), Ltd., Matbro House, Beddington Lane, Croydon, Surrey: Hire of contractors plant and civil engineering equipments.

Matbro, Ltd., Horley, Surrey: Manufacturers of 'Matbro' earth-moving equipment and fork lift trucks.

Lang Pneumatic, Ltd.

The above company are moving into larger premises at Owen Road, Wolverhampton, as from March 2nd. The telephone number will be Wolverhampton 25221-2-3.

International Plastics Exhibition

A collection of over two hundred of the world's finest plastics products for the home will be one of many special features of the International Plastics Exhibition at Olympia, London, from June 17th-27th. The design display is sponsored by our associate journal *British Plastics*, organizers of the exhibition, and arranged in conjunction with the Design Committee of the Plastics Institute.

'International' Record

A new record was established by the British construction equipment industry when the 2,000th British-made International Drott changed hands recently. It was handed over formally by Mr. A. M. Bowen, chairman and joint managing director of James Bowen & Sons, Ltd., of Edinburgh, to Mr. A. G. Watson, director of W. & J. R. Watson, Ltd., civil engineering contractors of Edinburgh. The contractors operate 12 International crawlers, consisting of one TD-24, three TD-18, one TD-14A and seven BTD-6 tractors, six of which are equipped with Drott skid shovels.

The sale also represented Bowen's 325th sale of the Doncaster-made BTD-6 tractor.

Salisbury Precision Engineering, Ltd.

Owing to the continued expansion of the mechanical handling division of the above company, it has been decided that Sherpa sales would be more conveniently organized from the company's head office, and all future correspondence should therefore be addressed to the company at Castle Road, Salisbury, Wilts (Telephone: Salisbury 4291). A showroom will, however, be retained at 1 Buckingham Palace Mansions, Buckingham Palace Road, London, S.W.1, where a representative range of standard models are available for inspection.

Martonair Agents in Switzerland

Martonair, Ltd., manufacturers of pneumatic equipment, have appointed agents in Switzerland—Notz and Co. A.G, Murtenstrasse 65, Biel-Bienne 1, Switzerland (Telephone 032-2-55-22).

Notz and Co. A.G. also have offices in Zurich.

India Places Huge Order for Earth-moving Equipment

The National Coal Development Corporation (Private), Ltd., controlled by the Indian Government, has ordered a total of 77 Euclids to help speed open-cast coal production for industry.

This is stated to be the largest single order ever placed by India for earth-moving equipment. It follows an order placed in 1957 for 48 similar units.

Euclids are distributed and serviced in India by Blackwood Hodge (India) Private, Ltd.

PUBLICATIONS RECEIVED

Automation
A new book, *Automation: What it is; How it works; Who can use it*, by Carl Dreher, has been published at 12s. 6d. net by Victor Gollancz, Ltd., 14 Henrietta Street, Covent Garden, London.

Agriculture
The Fabric of Farming, a new book by A. N. Duckham, dealing with the growth and principles of modern farming, has been published at 15s. net by Chatto & Windus, Ltd., 40-42 William IV Street, London, W.C.2.

Harbour Engineering
The latest in Nelson's 'Nautical Series' of books is *Introduction to Dock and Harbour Engineering*, by Rolt Hammond, A.C.G.I., A.M.I.C.E. It is published at 25s. net by Thomas Nelson & Sons, Ltd., Parkside Works, Edinburgh, 9.

Port of Bristol
The Official Handbook, 1959, for the Port of Bristol is now available from the publishers, F. G. Warne, Ltd., 13 Small Street, Bristol, 1.

Allis-Chalmers
New specification sheets on the lift tong attachment for the Allis-Chalmers HD.11G and HD.16G tractors are now available from Mackay Industrial Equipment, Ltd., Faggs Road, Feltham, Middlesex.

Cable Covers, Ltd.
A leaflet dealing with Talurit conical ferrules for mechanical splicing is available from Cable Covers, Ltd., St. Stephen's House, Westminster, S.W.1.

Igranic Electric Co., Ltd.
The above company, of Bedford, have issued a new publication, *Motor Control Centres*, describing very briefly their extensible control centres containing withdrawable panels.

James Neill & Co. (Sheffield), Ltd.
The above company, of Sheffield 11, have issued an interesting and informative publication *Permanent Magnets Summarized*, by J. G. Tyack, A.M.I.E.E., giving technical information on magnet design and materials.

Rendale Equipment
Two leaflets, dealing respectively with *Jib Cranes* and *Gravity Roller Conveyors*, have been published by Rendale Cranes, Ltd., and Rendale Handling, Ltd., of 5 Gt. Hampton Street, Birmingham, 18.

The Brockhouse Organization
Issue No. 5 for January-March, 1959 of *The Forge* published by the Brockhouse Group, 25 Hanover Square, London, W.1., contains interesting information concerning the activities of the group. In particular, a brief article gives details of the new HF 3-ton convertible salvage crane with a variable jib controlled by a luffing screw.

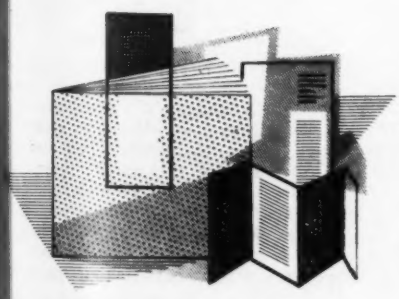
G.W.B. Control Gear
A new catalogue from G.W.B. Furnaces, Ltd., of P.O. Box No. 4, Dibdale Works, Dudley, Worcs, gives details of the company's control gear for a wide range of applications, including crane controls.

Dallow Lambert & Co., Ltd.
A new leaflet, No. 60, from the above company, of Thurmaston, Leicester, deals with their dust-control units.

'Accidents'
The January 1959 issue of *Accidents*, published by H.M. Stationery Office at 1s. 3d. net, gives special attention to accidents which might have been prevented if suitable protective clothing had been worn.

Detel Products, Ltd.
Details of a new Detel E/P paint, based on a combination of epoxy/pitch and giving an extremely tough and thick coating, have been issued by Detel Products, Ltd., Victoria Park Estate, South Ruislip, Middlesex.

Mechandling, Ltd.
A new leaflet on *Abattoir Equipment* has been issued by the above company, of 52 King William Street, London Bridge, London, E.C.4.



ABSTRACTS AND REFERENCES

Articles on mechanical handling published in all technical and industrial journals of the world are indexed and abstracted below. Whenever it is known, the published price of the journal containing the article is given.

The addresses of the publications concerned are given and applications for copies of the journals mentioned should be made direct.

EXPLOITING THE DIAGONAL
Is Current Thinking Obsolete? By James H. Greene. *Modern Materials Handling*, 221 Columbus Avenue, Boston 16, Mass., U.S.A. December, 1958. Pp. 70-71. 60c.

The author, who is associate professor of industrial engineering at Purdue University, maintains that we restrict ourselves unnecessarily when laying out manufacturing lines by thinking of them always as lying parallel or at right-angles to the walls of the building. He shows the advantages to be gained by using diagonals, especially if buildings or departments are square, and points out the wisdom of avoiding the oblong whenever possible.

HARDWOOD CONTAINERS
Don't Overlook Wood for Parts Handling. By Charles E. Thompson. *Modern Materials Handling*, 221 Columbus Avenue, Boston 16, Mass., U.S.A. December, 1958. Pp. 72-73. 60c.

Damage caused by handling had resulted in the rejection of up to 51 per cent of the parts undergoing treatment in an engine overhaul and repair organization on the west coast of America. Until it was rectified, this state of affairs threatened to kill the company. By spending $5,000 on wooden transport containers, they reduced the cost of damage to $48,000 in the first six months and $150,000 during the first two years.

In the course of his account of the means employed to achieve this improvement, the author recommends the use of hardwood or hardwood ply in preference to softwood for the containers and suggests ways in which it should be treated and fabricated.

PETROL VERSUS PROPANE
Gasoline or L.P.-Gas. By Howard A. Reinhart. *Material Handling Engineering*, 812 Huron Road, Cleveland 15, Ohio, U.S.A. December, 1958. Pp. 62-63, 117. 75c.

In arriving at an estimate of the relative merits of petrol and L.P. gas as fuels for internal-combustion engines, the author examines their characteristics in relation to efficiency and economy. Though on a

first analysis propane might appear to be at a disadvantage, and should in theory develop 25 per cent less power than petroleum fuel, it is shown that the theoretical factors indicating such a conclusion are, in practice, offset and outweighed by other considerations.

DRIVERLESS TRUCKS IN COMPUTER-CONTROLLED WAREHOUSE

Punch Cards, Driverless Trucks Speed Warehousing. *Material Handling Engineering*, 812 Huron Road, Cleveland 15, Ohio, U.S.A. December, 1958. Pp. 74-75, 96, 97. 75c.

Remotely controlled driverless trucks are used in the warehouse of the Lag Drug Co., Inc., Chicago—a wholesale warehousing organization serving 1,200 retail druggists. More than 30,000 different items are on the inventory and their movements are controlled by a system of electronic data-processing integrated with the materials handling organization.

Orders are picked directly into the self-steering trucks, on which the warehousemen ride without having to exercise any control, reserving all their energies for the tasks of selection and recording.

TURNTABLES IN THE WAREHOUSE

Turntables Keep Delivery Trucks on the Move. *Material Handling Engineering*, 812 Huron Road, Cleveland 15, Ohio, U.S.A. December, 1958. Pp. 84-87. 75c.

At the Up Bottling Co's premises in Los Angeles, road vehicles are driven on to turntables built into the warehouse floor for loading and unloading. The vehicles are loaded and unloaded from the side by fork lift trucks. Movement of the turntables is controlled by photoelectric cells actuated by spotlights mounted on the fork trucks and operated by their drivers.

More than 35,000 cases are handled during the day, working a double shift, and 60 trucks are loaded during each 8-hr shift.

HANDLING LIQUID CARGOES

Modern Tanker Practice for Cargo Handling Equipment. By E. H. W. Platt. *Transactions of The Institution of Engineers and Shipbuilders in Scotland*, 39 Elmbank Crescent, Glasgow, C.2. 1958-1959, vol. 102, part 2. Pp. 17-80. (Paper published 18th November, 1958 and copies may be available from the secretary.)

Handling equipment made necessary by the development of very large tankers—up to and over 100,000 tons deadweight capacity—is discussed by the author in the first major treatise to be published on the subject. It is pointed out that the handling of these large cargoes has now become a specialized function of an importance that is at least as great as that of the design of the hull and the main propulsion machinery.

Included in the equipment reviewed are the cargo piping systems, pipeline materials, valves and fittings and pumps, and arrangements for heating the cargo to reduce its viscosity and for cleaning the tanks.

An assessment is made of the trends of future development. These indicate that greater attention will be given to the theoretical study of the design of large pumping systems as problems of hydraulic engineering. It is possible, in the author's opinion, that spun cast-iron pipes will ultimately be replaced by plastic lines; that valves will be power operated and remotely controlled; that steam reciprocating pumps will be replaced by rotary pumps; and that centralized hydraulic power units will be installed. Mention is made of the problems of handling such materials as pressure-liquefied methane gas at a temperature of —250 deg F and of providing shore facilities for handling the towed flexible containers in which it is proposed to transport crude oil in bulk.

CONTINUOUS FINISHING PROCESSES

Flow Method Puts Quality Coat on Large Parts. By E. A Zahn. *The Iron Age*, Chestnut and 56th Streets, Philadelphia 39, Pa., U.S.A. December 25th, 1958. Pp. 50-51. 50c.

Methods are reviewed for the continuous application of low-pressure and high-pressure finishing coats to metal parts. Lengths of up to 29 ft can now be treated in this way if suspended vertically and units up to 60 ft long when handled horizontally. A wide variety of forms can be dealt with successfully and complete safety is assured. Recent improvements are said to have brought the cost of equipment within the reach of the small user.

MULTI-LEVEL CAR PARK

Autosilo Basel. *Fördern und Heben*, Bahnhofstrasse 61, Wiesbaden, Germany. January, 1959. Pp. 4-11.

Accommodation for 374 motor-cars is provided in a multi-storey garage adjoining the hotel International at Basle. It differs from the Karlsruhe car-park in the principle by which the vehicles are raised—the rear wheels only being gripped, leaving the front wheels free to move along guide-rails—and in being operated under fully automatic control as against the semi-automatic Karlsruhe system.

This system is described in operation, from the moment when a car arrives and its owner presses a button to its entry into a compartment of suitable size and again from the pressing of a button by the attendant to the return of the parked vehicle to its owner. All intermediate stages, including the gauging of the height of the car, the selection of the appropriate compartment, the manipulation of the vehicle and the corresponding operations in reverse, are performed entirely automatically.

COAL-HANDLING IN POWER STATIONS

Power Station Coal Handling. By Andrew Szold. *Electrical Review*, Dorset House, Stamford Street, London, S.E.1. January 16th, 1959. Pp. 95-101. 1s. 6d.

Plant designed for handling coal at rates of up to 1,600 tons/hour is reviewed. Typical design features of the equipment for handling the difficult class of material used in power stations, which often contains a large proportion of clay and fines and has a high water-content, are described and illustrated.

PROGNOSIS FOR THE STEEL INDUSTRY

Handling and Packaging. *Steel*, Penton Building Cleveland 13, Ohio, U.S.A. January 5th, 1959. Pp. 374-376, 378, 380. 50c.

In *Steel's* 1959 Forum on Technical Progress, spokesmen for the leading companies in the U.S. steel industry state their views on current trends and outlook for the future. Improvements in the design of cranes, conveyors and other equipment, which will make them better fitted to deal with the exacting requirements of a modern steelworks, are anticipated by several spokesmen. The general concensus of opinion points to a period of expansion in the use of mechanical handling equipment.

WELDING MANIPULATORS FOR BRIDGE GIRDERS

Production Line Steps up Girder Welding. By J. V. Banks. *The Iron Age*, Chestnut and 56th Streets, Philadelphia 39, Pa., U.S.A. October 30th, 1958. Pp. 90-92. 50c.

Bridge girders up to 135 ft long and 11 ft deep are fabricated on an in-line basis at the Kaiser Steel Corporation's works at Montebello, California. Equipment for handling the enormous sections of steel plate used in their construction and for manipulating the girder assemblies into their welding positions, are described in this article by the company's production manager.

CARGO HANDLING IN GERMANY

Umschlag im Hafen. *Fördern und Heben*, Bahnhofstrasse 61, Wiesbaden, Germany. Export number, 1958-1959. Pp. 4-9.

Cranes, transporters, conveyors and radio-controlled fork lift trucks are included in an illustrated review of equipment in use in German docks and private wharves.

AUTOMATIC GEAR-PRODUCTION LINE

How Russia Produces Gears Automatically. By Peter Trippe. *Metalworking Production*, 95 Farringdon Street, London, E.C.4. January 23rd, 1959. Pp. 135-141. 1s. 3d.

The Krasnoi Proletarii line for the production of gears, claimed to be the first automatic plant of its type in the world, is described in this article. It is based on a report by a Soviet engineer, which appeared in the Russian journal *Automation and Mechanization*.

RETURNABLE UNIT-LOAD CONTAINERS

Presenting the Case for Returnable Containers. By W. B. McClelland. *Materials Handling*, 2 Bloor Street East, Toronto 5, Ontario, Canada. November, 1958. Pp. 24-28.

In a talk given to the Hamilton chapter of the American Materials Handling Association under the title 'Purchasing in Pack Lots', on which this article is based, Mr. McClelland presented a strong case for the use of returnable containers owned by the vendor. The main arguments, supported by charts and analysis sheets, are stated in the article.

MATERIALS HANDLING AS MANAGEMENT FUNCTION

Organize a Materials Handling Group for Cost Saving Results. By G. B. Stewart. *Materials Handling*, 2 Bloor Street East, Toronto 5, Ontario, Canada. November, 1958. Pp. 29-31.

That the time has arrived for a change of status for the materials handling engineer and that his job should cease to be regarded as a mere service function and become a function of management invested with departmental authority, is the theme of this paper. Its author was one of the finalists in the 1958 Award Contest sponsored by Clark Equipment Co.

Amplifying this contention, he submits a proposal for the organization of a typical department and its terms of reference and activities.

(*Continued on page 185*)

NEW FOUNDRY METHODS
Ford Opens New Aluminium Diecasting and Permanent Mold Foundry. By Robert H. Herrmann. *Foundry*, Penton Building, Cleveland 13, Ohio, U.S.A. January, 1959. Pp. 64-69. $1.

Handling is shown to be adequately mechanized in a description of the new Sheffield, Ala., foundry built by the Ford Motor Co. It produces the aluminium castings for 67 different components of Ford engine and transmission assemblies.

RECENT PATENTS

The following are brief extracts of recent United Kingdom patents which we believe will interest our readers. For full details the original patent specifications should be consulted at, or bought (3s. 6d. each) from, The Patents Office, Southampton Buildings, Chancery Lane, London, W.C.2.

BOTTLE CONVEYOR
Hugh Campbell (London.) Ltd., of Beckenham.—U.K.802024.

Bottles held, even at 60-deg incline, by plate-like members, which can be in pairs forming open compartments.

LOAD TONGS
Hepperstall Co., Pittsburg.—U.K.802084.

A sheet, coil or metal plate handler for variable width but fixed height, lever controlled so that a crane need not move to get correct height for various loads.

WATER TROUGH
Philips Electrical Industries, Ltd., Finsbury.—U.K.802120.

Cast wax models move and cool, floating without deformation, in a pumped water trough—otherwise they can deform under own weight, e.g. on belt conveyor.

TRANSFER MACHINE
Société Onanaise de Construction Mécanique, of France.—U.K.802162.

Transfer machine for power presses, drills, milling machines, etc., having grips which collect and move pieces into position, under pneumatic control.

ROTARY TIPPLERS
Strachan & Henshaw, Ltd., Bristol.—U.K.802172.

With a wagon-weighing arrangement, easily put into operation and not subject to load whilst wagon is moving.

SHOVEL ATTACHMENT
W. M. Henderson, Dumbarton.—U.K.802183.

For tractor use, with pivoted jib and links, which can be held at any position for luffing.

LIFT CRADLE
Stevedores Equipment Services Co., Ltd., of Liverpool.—U.K.802308.

Improved version of patent 703861—a meat, etc., cradle for discharging ships' holds, of rectangular form with runners and stop supports, made from tubular steel.

BOTTLE CRATE
Ross Bros., Ltd., of Leeds.—U.K.802371.

A form of wooden box crate with nailed spigots to separate bottle bottoms.

FEED HOPPER
James Manufacturing Co., of Wisconsin.—U.K. 802421/2.

Mechanical poultry feed supply using a reciprocating trough, with surplus feed being returned. There is a flapper-plate sensing device to control feed rates.

CARGO TURNBUCKLE
Eastern Rotocraft Corporation, Pennsylvania.—U.K.802561.

For heavy equipment attachment in ships' holds or rail cars to hold trailers, tanks, etc., having a telescopic housing to give a large tensioning take-up range.

TRUCK TINES
Clark Equipment Co., of Michigan.—U.K.802614.

Industrial lift truck with adjustable position forks, using a cheap and simple arrangement of pivoted lever.

MOBILE CRANES
Ransomes & Rapier, Ltd., Ipswich.—U.K.802629.

A jib mounted on two wheels and steerable castor with a safe-load indicator to prevent upturning, with a vertical force indicator of hydraulic-piston type between the castor and chassis.

MINE CAR HANDLING
W. H. Barker & Sons Engineers, Ltd., of Stoke.—U.K.802630.

Free-running tub retarder using a chain in a track with reduced wear between it and car engaging point, by use of pads sliding along a support beneath active part of chain.

HAND TROLLEY
Fordham Pressings, Ltd., Wolverhampton.—U.K.802638.

Golfers' trolley with a sling support to the load bag for preventing rapid wear.

ROPE HOIST GUIDES
Gutehoffnungshutte Sterkrade A.G., of Oberhausen.—U.K.802732.

A direction-changing guide for tower hoists in which a series of pulleys are arranged along the periphery of an arc to reduce wear and need for replacement, with a short extension set giving a straight line.

PNEUMATIC GLASS CONVEYANCE
Fibreglass, Ltd., of St. Helens.—U.K.802748.

A form of distributor for glass fibres in a fluidized conveyor to prevent adhesion to walls and avoiding turbulence so that adhesive can be blown in to coat the suspended particles. A venturi throat is used with a right-angle bend at the minimum portion.

FABRIC HANDLING
Wolsey, Ltd., of Leicester.—U.K.802750.

Handler device for knitted tubular jersey having wale spirality which straightens it by stretching in a roughened guide whilst wet. Avoids expensive hand operations.

ASSOCIATED ILIFFE TECHNICAL BOOKS

Books Recommended by

'MECHANICAL HANDLING'

ABACS OR NOMOGRAMS
A. Giet, Translated and revised by J. W. Head, M.A.(Cantab.), and H. D. Phippen, M.A.(Edin.), B.Sc. (Lond.). 35s. By post 36s.

CONSTRUCTIONAL STEELWORK SHOP PRACTICE
John Farrell. 15s. By post 16s. 1d.

ELECTRONIC COMPUTERS: Principles and Applications
Edited by T. E. Ivall. 25s. By post 26s.

MATERIAL HANDLING IN WORKS STORES. Second Edition. The Fork-Lift Truck and Pallet System
L. J. Hoefkens. 18s. By post 19s.

PRINCIPLES OF MASS AND FLOW PRODUCTION
Frank G. Woollard, M.B.E., M.I. Mech.E., M.I.Prod.E., M.S.A.E. 25s. By post 26s. 4d.

PRODUCTION ENGINEERING: Practical Methods of Production Planning and Control
J. S. Murphy, A.I.I.A. 12s. 6d. By post 13s. 5d.

Obtainable from all booksellers or direct from

THE PUBLISHING DEPT.
DORSET HOUSE
STAMFORD ST., LONDON, S.E.1

GOODS TRUCKS
Siron Developments, Ltd., Basingstoke.—U.K. 802810.

Hand or motorized goods trucks, somewhat as per patent 594789 with a given arrangement of motor drive wheels and coupling.

EGG HANDLING
Newman Hender & Co., Ltd., of Trowbridge.—U.K.802816.

Feed conveyor from paperboard egg trays to sizing devices with suction-cup pick-up to reduce handling and breakage.

COMPACTOR ROLLER
Sotrema, of Casablanca.—U.K.802865.

A pneumatic-tyred roller adapted for irregular surfaces and able to adjust pressure by varying load in the ballast hopper.

MINE HOIST CONTROL
B.T.H. Co., of Aldwych.—U.K.802867.

Protective circuits for winders to avoid excess speed at end of travel with very low time lag and able to cope with both up and down loads simultaneously.

GRAVITY DAVITS
Davit Developments, Ltd., of Edinburgh.—U.K. 802961.

A starter rope or chain is used to overcome inertia.

SHEET CONVEYOR
F. M. Wagoner & G. L. Monta, of Chicago.—U.K.802968.

Conveyor with carrier for long objects, e.g. sheet being automatically sprayed, oven dried, turned round in a minimum distance, in an automatic guide through 180 deg.

PULVERULENTS
Fuller Co., of Pennsylvania.—U.K.802972.

Flour, cement, etc., are moved by partial fluidization to alter the angle of repose, combined with vibration—so that flow uphill can occur.

MOBILE LOADER
Athey Products Corporation, of Chicago.—U.K. 802983.

An elevator with bottom plate of given design and shape—fed by scraper blades on a belt.

MAST LIFT TRUCKS
E. Kaye & J. R. Sharp, of Basingstoke.—U.K. 803066/7/8.

A system with minimum height, having two lifting jacks, rams, cylinders and pulleys with chains, etc., using wheels in pivoted pairs.

WEIGHER LOADER
Ransomes & Rapier, Ltd., Ipswich.—U.K.803112.

Concrete mixer hopper pivoted with weigher lever actuated by bottom rollers.

BAG STACKING
F. P. Winesett, Oakland.—U.K.803115.

Polythene film bags are handled and stacked without friction contact to avoid static problems.

CHURN EMPTIER
Hargreaves Engineering Co., Blackburn.—U.K. 803138.

Improvement on patent 699078 covering a milk can emptier, using elevator and tipper whilst preventing can exterior dirt getting into milk.

ROAD RIPPER
Caterpillar Tractor Co., California.—U.K.803155.

Scarifier with linkage so that there is no force on vehicle.

TRANSPORTER SWITCH
C. J. Allen, of New Zealand.—U.K.803303.

Rail switch for suspended skids, e.g. in meat warehouses, with a lift to avoid wear at the blade junction.

CONVEYOR CONTROL
A. E. Rowe, of Manchester.—U.K.803333.

Withdrawable stop, operated by feeler, to avoid crate collisions at junction of conveyors.

ROLLER BEARINGS
J. Collis & Sons, Ltd., London.—U.K.803340.

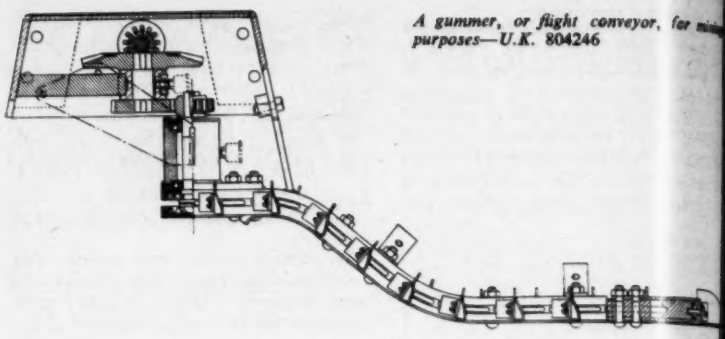
Conveyor rollers with resilient bearings to even out wear effects.

BOTTLE WASHING
Gimson & Co., Leicester.—U.K.803351.

Improves patent 654905 for a feed to a drum washer, with a safety device dependent on feeling resistance.

WHEEL BARROW
Benjamin Baker (Lye), Ltd., of Worcestershire.—U.K.803436.

Cheap but rigid design with effective bracing.



A gummer, or flight conveyor, for mi... purposes—U.K. 804246

CHURN INVERTER
Holstein & Koppert Maschinenfabrik Phoenix G.m.b.H., of Dortmund.—U.K.803467.

Inclined conveyor belts deliver churns to and from washing systems, etc.

LINK CONVEYOR
P. R. Masheder, of Liverpool.—U.K.803496.

A rotatable band delivers goods to pre-set stations.

GRAVITY DAVIT
Marine & Allied Industries, Ltd., Liverpool.—U.K.803594.

Aid to starting movement, using foot-operated screw-jack and cam.

DOUBLE WINCH
l'Equipment Minier, of France.—U.K.803632.

A two-drum winch for mine use, simple, robust and works cables in dusty atmosphere with minimum attention.

TRUCK COVER
P. A. Mege, of France.—U.K.803706.

A hinged cover in sections which give free access to wagon, etc., when opened.

BAKERS' OVEN
Baker Perkins, Peterborough.—U.K.803740.

Improves patent 526670 for conveyors with steam atmospheres, under control by suction at given places.

PARTICLE CHUTE
A. B. Blanch & Co., Ltd., Crudwell.—U.K.803838.

Grain, etc., raiser screw conveyor with automatic level control.

EARTH SCRAPERS
General Motors Corporation, Detroit.—U.K. 803847.

Carrier bowl has pivoted apron with power raise, and articulated drive to vary power applied as load accumulates.

PNEUMATIC ELEVATORS
Zarody Presneho Strojirenstri, Gottwaldorf.—U.K.803867.

A personnel or load lift shaft design, simple to work using compressed air.

LOAD SKID
H. Barthelemy, France.—U.K.803880.

A triangular platform skid with three castors for furniture removal.

BULK CARRIER
F. G. Smith Motors, Ltd., London—U.K. 803891.

Screw conveyor discharge for lorry with flour, cement, etc., which can also serve for sack delivery when fluidized conveyor not used.

INGOT TIPPER
Huttenwerk Rheinhausen A.G.—U.K.803905.

Ingots delivered by crane are tipped ... horizontal by movable series of roll... sets.

CONVEYOR
T. Wall & Co., Acton.—U.K.803913.

Ice-cream conveyor belt carrying ba... to freezing blast chambers.

BARREL HANDLER
D. Atkinson, Guildford.—U.K.803982.

Wheeled frame carrier with radial ba... to hold a drum by its flanges.

MINE CONVEYOR
Coal Industry Patents, Ltd.—In U.K.804246.

A gummer for removing coal fragmen... from undercut faces, feeding face conve... ors, using a cable flight with shroude... return which can be cranked. It can b... geared to the cutter for power.

PORTABLE DRILL RIG
Piling & Construction Co., Croydon.—U... 804247.

A pivoted tower set on the back of ... lorry, with hydraulic erection for seam... drilling, with control of drill feed an... pressure during penetration, withdraw... and able to cope with varied resistanc...

BAKING CONVEYOR
Tancred & Langley, Ltd., of Leeds.—U.K.805...

Gas-fired Peel-type oven with convey... for baking having hot air passing throu... it from below to above.

BAG FILLING
Modern Coffees Inc., Boston.—U.K.806123.

Automatic machine for filling sm... coffee bags of paper, sealed by pressure ... heat adhesive.

METAL CRATES
Dairy Supply Co., Park Royal.—U.K.806147.

Polygon, tapered-side, open crates wh... nest into, or rest on top of, each other ... desired.

PLASTIC ROLLERS
Epsylon Research & Development Co., Ltd., Feltham.—U.K.806179.

Rollers driven, when required, by ... hitting vanes inside their hollow cen... which can be plastic.

LOG DEBARKER
Canadian Ingersoll Rand Co., Montreal.—... 806469.

Rotary cutters are automatically co... ing as logs feed through cutters, oscilla... being prevented and release occur... when machine is stopped.